PRELIMINARY DESIGN OF A HUMAN RESOURCE ACCOUNTING SYSTEM FOR THE UNITED STATES NAVY

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(1962)

SUBMITTED IN PARTIAL FULFILLMENT

OF THE REQUIREMENTS FOR THE

DEGREE OF MASTER OF SCIENCE

at the

MASSACHUSETTS INSTITUTE OF

TECHNOLOGY

June, 1972

Preliminary Design of a Human Resource Accounting System for the United States Navy

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Submitted to the Alfred P. Sloan School of Management on April 7, 1972, in partial fulfillment of the requirements for the degree of Master of Science in Management.

ABSTRACT

Over the past decade, Navy personnel managers have shown an increased interest in personnel costs. At the same time, the concept of considering employees as assets or resources has developed. The purpose of this thesis is to accomplish the preliminary design work for a human resource accounting system which would, if implemented, provide Navy decision makers with human resources cost information relevant to their particular needs. In addition, the thesis uses current management information systems theory as a guide for human resource accounting system design.

The thesis presents an overall human resource accounting model and develops input methods and basic processing capabilities. Systems support in the area of officer utilization is examined and designed.

Thesis Supervisor: Charles A. Myers
Title: Professor of Management

ACKNOWLEDGEMENTS

I would like to extend my sincere thanks to my thesis advisors, Professor Charles A. Myers and Dean Thomas M. Hill, for their assistance, comments, and support throughout this project. The Navy's Personnel Research Division, which provided some of the funds necessary to complete the research, also deserves a special vote of thanks. Finally, I am indebted to my wife, Sharon, who typed the final draft and provided the encouragement necessary to complete the study.

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I. INTRODUCTION

A. THE PROBLEM AND ITS SETTING:

The United States Navy spends huge sums on acquiring and developing an effective work force. Over the past decade, policy makers and personnel planners have become increasingly interested in the costs associated with the Navy's human resources. Section B of the Bibliography reflects the effort expended since 1963 to provide Navy management with personnel cost information.

At the same time top level managers have also become increasingly aware of the importance of the Navy's human element. In one of his well known "Z-Grams," the current Chief of Naval Operations, Admiral Elmo Zumwalt, emphasized this point and stated, "My deep belief that the Navy's greatest resource lies in our human assets has been previously stated and is the backbone of my efforts in the personnel area to date. Feedback from recent field trips, the retention study groups, and many other sources indicates the desirability of adapting some of the contributions of the behavioral sciences to the effective management of these vital assets."[1]

This classification of people as "vital assets,"

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[1]See U.S. Naval Message from CNO to NAVOP, Date Time Group; 041555z Nov. 1970, Subject: Human Resource Management, (Z-Gram 55)

and the growing interest in costs associated with people give rise to a variety of serious questions, e.g.: What is the "book value" of these important assets as measured in dollar terms? Is that book value increasing or decreasing? What are the costs of replacing these vital assets? Are they being properly utilized? But these "little" questions, difficult as they may seem, are only spokes in the wheel of a much broader and more difficult managerial question: How can the process of acquiring, developing, maintaining and utilizing the Navy's human resources be more effectively and efficiently managed?

Regardless of whether or not the above questions are in fact answered, managerial behavior and decisions affect the answer: deciding to send a sailor to school increases his potential and hence his book value; by deciding to place him in a job where his acquired potential may be utilized, some return will be realized on the training investment; and if managerial behavior or policy decisions drive him out of the Navy, costs and time are involved in replacing his capabilities. The growing interest in personnel costs and behavioral science concepts represents a conscious effort to improve decisions affecting the Navy's human resources. However, the search for information may be received too late to be of use in the decision making process, or it may not be processed properly to

support the decision at hand.

B. THE PURPOSE OF THE STUDY:

The principal problem outlined above (managing the process of acquiring, developing, maintaining and utilizing the Navy's human resources) is obviously much too extensive to be addressed by one study. The primary purpose of this thesis is to accomplish the preliminary design work for an information system which would, if implemented, provide Navy decision makers with human resources cost information relevant to their particular needs. The information system designed will be referred to as a human resource accounting (h.r.a.) system.

C. APPROACH:

1. The Population or Environment to be Monitored:

The Navy's human resource inventory is comprised of approximately 500,000 enlisted personnel, 70,000 officers, and 350,000 civilians. Each population has particular characteristics which set it apart from the other two. A model which included all three populations, in addition to having a low probability of implementation, would be extremely complex and require an overwhelmingly large supporting data base. For these reasons, this study will consider only officer personnel although the general model developed would be applicable (with minor modifications) to almost any group or organization, including private industry.

2. Plans and Decisions to be Supported:

A wide variety of plans and decisions are or could be supported by officer cost data, e.g., recruiting budgets, training and education plans, efforts to improve retention, etc. An attempt to address all such information needs in detail is beyond the scope of this study. Therefore, rather than approaching the design problem on the basis of what decision areas require support, a much more fruitful approach will be to develop the system on the basis of the level and nature of the decision making process to be supported. In particular, the system is

expected to initially support decision making at the "management control" level. Furthermore, the most interesting decision areas in the above category where systems support has high potential are the "unstructured" and "semistructured" areas. The characteristics of the resulting system will be strongly influenced by the quoted terms above. The terms are fully defined and further discussed in Chapter III.

3. The Model and Measures to be Used:

The dollars spent on acquiring, developing and maintaining the Navy's human resources are spent in anticipation of some return over extended periods of time. In this sense, those expenditures would be considered investments. The developed model accounts for such human resource investments in a manner similiar to a physical resource accounting model, by recording investments and then amortizing them over a period of expected return.[2] An account

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[2]The concept of accounting for human resources as investments and depreciating them over a period of expected return is not unique to this study. Several educational institutions are conducting research in this area, and several industrial organizations have installed or are installing human resource accounting systems. The Navy has also recognized the concept subjectively through periods of obligated service and objectively in some of its cost studies. For the interested reader, Section A of the Bibliography lists much of the published literature which deals with human resource accounting.

is maintained for each officer, and individual accounts can be aggregated and processed to support a particular decision area. For the purposes of this study, a computer based system is assumed.

D. SUMMARY:

Chapter II serves to introduce the reader to human resource accounting by developing and defining the basic model, and working through a simple illustrative example.

Recently, a body of theory has developed covering decision making and information or decision system design. ChapterIII integrates this theory, relates it to h.r.a. system design, and develops a set of desirable system characteristics based on the integrated framework.

Preliminary system design is the subject of Chapter IV. Primary emphasis is placed on developing feasible means of generating a useful data base, a critical problem considering the nature of the information desired. Then, the basic system operations are covered.

In Chapter V, the framework presented in Chapter III is further related to implementation. Systems support of decision making related to officer utilization is designed.

Concluding remarks and recommendations are finally presented in Chapter VI.

II. THE BASIC STRUCTURE OF THE H.R.A. MODEL

A. OVERVIEW:

Generally accepted accounting principles require that the cost of a physical or fixed asset be spread over the expected useful life of the asset in such a manner as to equitably match the cost with the services obtained. This procedure is commonly labeled depreciation accounting. It is not a process of valuation, but one of allocation.[3] When human assets are acquired by an organization, costs are also involved (Although the statement applies to any organization, the Navy is the organization in question here; more specifically, acquisition of officer personnel by the Navy). Likewise, when people are trained, formally or informally, that training is accomplished only at a cost. Such costs are incurred by the Navy in anticipation that the recruitee or trainee will in return make some contribution during his service life. By "writing down" these initial costs over the expected useful life of an individual, depreciation accounting can be extended to include the human element of an organization.

Before proceeding, the reader should be aware

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[3]See Robert N. Anthony, Management Accounting, 4th edition, Richard D. Irwin, Inc., Homewood, Ill., 1970, p. 148.

that the Accounting Principles Board does not recognize as generally accepted accounting principles for external reporting purposes, the practice of accounting for human resource costs as investments. However, whether in private industry or government, where human resource accounting is being developed to satisfy an internal information need rather than an external reporting requirement, there are no applicable statutes governing procedures to be followed. Therefore, although similarities exist, this study will tend to minimize the analogies between human resource accounting and conventional accounting practices.

A simplified model, applicable to the Navy in general appears in Figure 1.[4] The figure should be helpful in understanding the remaining sections of this chapter.

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[4]Adapted from a human resource accounting system model appearing in the published literature. For example, see R. Lee Brummet, Eric G. Flamholz and William C. Pyle, "Human Resource Measurement - A Challenge for Accountants," The Accounting Review, Vol. XLIII, No. 2, April, 1968, p. 222.

A SIMPLIFIED MODEL OF THE H.R.A. SYSTEM

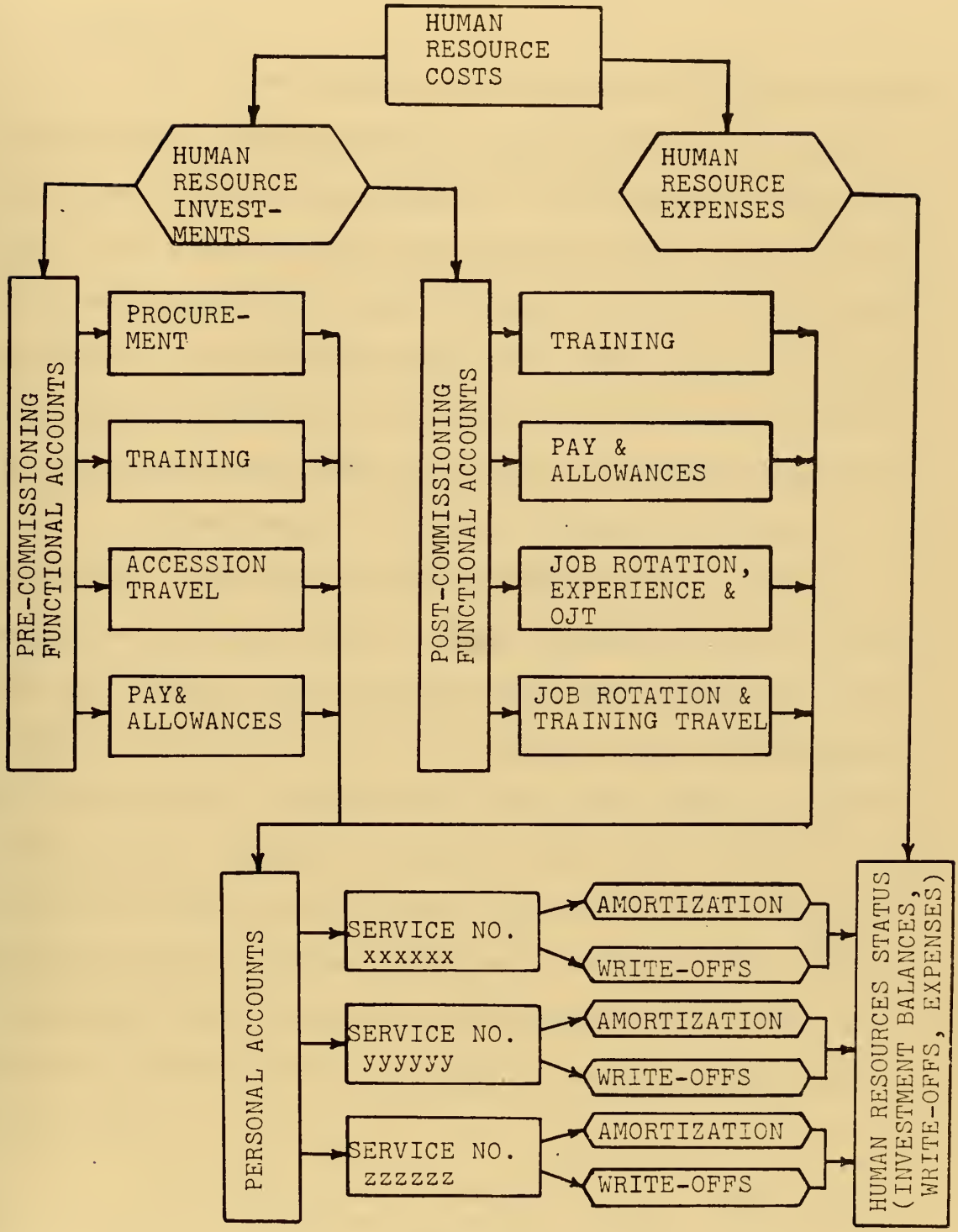

Figure 1

B. INVESTMENTS:

The first step in the model is to decide whether a particular officer personnel cost should be classified as an investment or an expense. If a standard accounting cycle (e.g., the fiscal year) were applied, those expenditures which provided benefits for one year or less would be handled as expenses, while those which provided return for periods in excess of one year would be accounted for as investments and amortized over an appropriate period.

Investments have been classified into two categories: pre-commissioning investments, and post-commissioning investments. These categories have in turn been sub-divided into several functional accounts. The intent of this study is not to create a new terminology but to develop a usable model. For this reason, classifications and functional accounts have been chosen to conform as closely as possible with the terms used in the existing body of officer personnel costing literature.[5] In addition, many costs are currently reported under the present classifications; the use of existing reporting

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[5]Primary source of classification terminology has been WOS 71-4, Officer Personnel Costs: OCS, AOC, AVROC, NAVCAD, NROTC-C, NROTC-R, Naval Academy, Clary, J. N., and Creature, J.T., March, 1971

channels and terminology wherever possible will reduce implementation problems and costs tremendously.

1. Pre-Commissioning Investments:

The funds expended on potential officers prior to their commissioning are spent in anticipation that they will in fact be commissioned and provide some useful service. In this respect, pre-commissioning costs should be considered investments. In fact, they are recognized subjectively as investments through a period of obligated service following commissioning. Most pre-commissioning investments (per capita costs) have been well identified by existing studies. The following functional accounts are used:

a. Procurement: Bringing future Naval officers on board is not free. Expenditures are made for operating recruiting offices, advertising, paying recruiters' salaries, testing and evaluating potential candidates, administration, physical examinations, interviewer travel, etc. These dollars are spent with the expectation that a portion of those candidates considered will be accepted and provide some useful service during their employment. In this respect, the total recruiting costs would be allocated among the successful candidates.

b. Training: Once an officer candidate has been selected, additional investments are made prior to sending him to his first "real job." Various programs and institu-

tions such as the Naval Academy, NROTC, and OCS are maintained to provide officers with prerequisite training and education.

c. Accession Travel: The following definition should clarify this account: "Accession travel includes movements from home or recruiting (procurement) station to a training center and to the first permanent duty station after initial training. The first permanent duty station may be an operational billet or a school of 20 weeks or more duration."[6]

d. Pay and Allowances: While undergoing pre-commissioning training, a potential officer receives basic pay. Depending upon the program, he may also receive subsistence in kind and a clothing allowance.

2. Post-Commissioning Investments:

Once an officer has been commissioned, the Navy does not stop investing in him. The pre-commissioning training and education he received are only a beginning. The Navy maintains a vast array of technical schools; it finances post-graduate work for its officers; it invests heavily in formal programs for flight and submarine training. In addition, much of the time a young officer spends on the job is spent gaining experience and knowledge which will contribute to his future performance. Through job rotation,

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[6] Ibid., p.5.

he is acquainted with a variety of technical and managerial problems, his knowledge of which he is expected to draw upon when necessary in future periods. The following functional accounts are used:

a. Training: The schools maintained by the Navy are representative of a significant investment in human resources. A variety of costs are involved in their operation. Instructors must be paid, supplies must be purchased, equipment and buildings must be purchased and maintained, etc. Even when private educational institutions are used, tuition and book allowances are involved. If these programs were suddenly eliminated, the total effect would not be felt immediately, but would be distributed over future years.

b. Pay and Allowances: While an officer holds "student" status, his services in an operational billet are lost. Therefore, his pay and allowances, rather than being compensation for past or present services, are being paid in expectation of future contributions.

c. Job Rotation, Experience and OJT: When personnel are transferred to new jobs, additional expenditures are incurred. Upon reporting to the new command, an individual may attend a formal orientation program. He spends a significant portion of his time familiarizing himself with new regulations, learning the command's history, philosophy, objectives, communications channels, and under-

standing the people with whom he is to work. After the initial familiarization period, individuals continue to spend a portion of their time building their capabilities through informal and on-the-job training programs. New skills may be acquired which may provide long-term return to that command or the Navy as a whole. Given a new task, an individual will gain valuable experience, enabling him to perform that task more efficiently in the future. Many of these investments will be salary allocations of the individual, his superiors and subordinates.

d. Job Rotation and Training Travel: Travel costs are generally (but not always) involved when an individual is ordered to a new job or to school. Per-diem may also be paid.

C. AMORTIZATIONS:

Continuing down and to the right in the figure, after a particular outlay has been classified as an investment and placed in the proper functional account it is applied to the appropriate individual account. An amortization schedule is then determined. A range of alternatives exist in determining this schedule.

Existing procedures call for the recording of all human resource costs as expenses, thus implying an amortization period of zero (or one accounting period) within this framework. This is actually one alternative, but an alternative which this study, of course, claims to be a poor one. Recalling that the purpose of depreciating physical assets is to spread the cost over the assets' expected useful life, other alternatives come to mind.

The expected useful life of a human resource depends upon the nature of the investment and how long a particular individual can be reasonably expected to provide a useful service. Some human resource investments are made with the expectation that return will be realized over the individual's entire period of employment, e.g., any pre-commissioning costs, while others are made in expectation of return over shorter periods of time, e.g., costs of a course on operating a particular model of equipment.

The first serious alternative then, might be to

decide upon "usefulness periods" for particular investments, statistically determine an individual's expected remaining working life, and amortize investments over the shorter of these periods. However, this procedure has at least one major deficiency which could not be compensated for by system manipulations. The problem lies in the definitional difference between the expected useful working life of an individual and his expected working life. Although expected working life could be determined in a variety of ways, it is always the period of time a real or average individual is expected to remain in the Navy. On the other hand, expected useful working life for the purposes of this study is defined as the period of time over which an organization believes an individual could provide a useful service. This period could be shorter or longer than his expected working life. For example, by providing for retirement benefits after 20 to 30 plus years of service, the Navy indicates rather explicitly that it anticipates a useful working life of at least 20 years.

This study will assume a minimum expected useful working life of 20 years. All pre-commissioning investments will be amortized over this period.

Determining amortization schedules for post-commissioning investments presents a different problem. On one hand, a method must be developed which will provide

useful information with acceptable accuracy, while on the other, the method cannot be so complex as to impair the user's understanding of the system and thus his confidence in the output. Suffice it to say at this point that post-commissioning investments will be amortized over fixed periods determined by subjectively evaluating their individual usefulness periods. For example, the costs of post-graduate education in financial management might be amortized over a ten year period, while the costs of a Damage Control Assistant course might be amortized over a five year period.

D. WRITE-OFFS:

Write-offs are necessary whenever one of three conditions exist. The first and most obvious is when an individual's service is voluntarily or involuntarily terminated prior to the complete amortization of all investments in him. Consider the officer who resigns after his obligated service of four years is completed. Assuming a straight line depreciation schedule, four fifths of the pre-commissioning investments in him will be recorded as a write-off or loss. Any unamortized portions of post-commissioning investments will also be recorded as a write-off.

The second and third conditions occur when an acquired skill has become obsolete because of technological advances or non-utilization. For example, an officer might be trained in a particular weapons system. Assume the usefulness period of that investment was determined to be five years. If, after three years from the date of the original investment, that particular system became obsolete, a write-off would be required since no return would be expected during the forthcoming two years. If the system had not become obsolete, but the officer was transferred to a job where his skills could not be utilized, a write-off would again be necessary.

The write-offs discussed above, when summed over

the officer force (either partial or entire force), indicate the following: (1) the dollar losses of voluntary and involuntary officer turnover in relation to a 20 year base line, (2) officer personnel costs as a result of technological advances, and (3) officer personnel costs attributed to less than optimal utilization.

E. AN EXAMPLE:

Perhaps the best way to illustrate the process and the investment magnitude is by simple example. Costs which have already been identified by previous studies will be used whenever possible. In situations where cost figures are not available a brief explaination and justification of the method used to determine a figure will be presented. The example is summarized in Figures 2 and 3.

John Jones, during his high school years had no real plans for the future. His parents could provide little, if any, financial support for John to attend college. But John had good grades, and his counselor advised him to take any scholarship tests which were offered such as National Merit and NROTC exams. Fortunately for our example, John received a high grade on the NROTC exam and was notified during the spring of his senior year to report to a nearby Naval base for physical examinations, psychological testing, and personal interview. He was also provided with an inch-thick packet of forms to be completed and returned. Toward the end of his high school career John received a letter of congratulations. He had received an NROTC scholarship to the university or college of his choice. After successfully completing four years of college, John received his degree and was commissioned an Ensign in the U. S. Navy. Before graduation he had

requested and received orders to submarine school.

This is a convenient point at which to summarize the Navy's pre-commissioning investment in John. Recall that all pre-commissioning outlays are to be considered investments and will be amortized over a minimum expected useful working life of 20 years. Average pre-commissioning costs are presently available.[7] The average dollar figures for each functional account and the symbol identifying the responsible Bureau of Naval Personnel office or activity are as follows:

1. Procurement: $50, Pers-B6
2. Accession Travel: $658, Pers-H11
3. Training: $7,425, Pers-H222
4. Pay and Allowances: $4,161, Pers-H222

Upon commissioning, an individual account is opened in John's name. For simplicity, at least in this example, all pre-commissioning investments are posted as historical costs to his account as of the date of commissioning. Any discounting procedure will be neglected here.

Following graduation from submarine school, John was ordered to nuclear power training. During his year at nuclear power training he was promoted to Lieutenant (junior grade). After completing nuclear power training

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[7] Ibid., p. A-29.

he reported to his first "real" job aboard a nuclear submarine. He was immediately handed volumes of reading material; ship's instructions, squadron instructions, operating manuals, etc. With the help of other officers and men aboard ship he started learning the ship's systems. In addition to learning his regular job, he worked on other professional qualifications, and after about a year was designated "qualified in submarines." He was also promoted to Lieutenant after three years of commissioned service.

After two years of submarine duty however, John decided he didn't care for submarines and requested that his next duty station be a nuclear powered surface vessel. Since submarine duty is primarily voluntary, John's request was honored, and he was ordered to a nuclear powered aircraft carrier. Again, much of his time aboard the new ship was spent learning new systems, procedures, etc. He was sent to two short schools during his first six months aboard: NBC Defence (Afloat), and Radiographic Safety Officer.

John's obligated service was five years. Although he had at one time intended to make the Navy a career, he resigned after six years of active duty. During an interview just prior to terminating, John stated that he was resigning "because the working and operating

schedules don't permit a stable family life."

Some average post-commissioning investments have also been identified.[8] They are as follows:

1. Training:
   a. Submarine School: $2,779[9]
   b. Nuclear Power School: $6,642
   c. NBC Defence (Afloat) School: $393
   d. Radiographic Safety Officer School: $339
2. Pay and Allowances while at:
   a. Submarine School: $3,641
   b. Nuclear Power School: $7,637
   c. NBC Defence (Afloat) School: $925
   d. Radiographic Safety Officer School: $370
3. Job Rotation and Training Travel:
   a. Training to first duty station: $1,035
   b. First to second duty station: $1,291
   c. No travel expenses involved for two short schools.

Costs associated with experience and on-the-job training have not been identified. Many authors have

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[8] Ibid., p. 7, p. A-29.

[9] Figures pertaining to submarine school are now out of date due to a shortening of the training period.

addressed this subject, emphasizing the importance and magnitude of such investments.[10] One Navy sponsored study concluded that there was "a need for on-the-job training costs for use in personnel cost studies and for other managerial purposes,"[11] and developed a system which would provide a reasonable estimate of on-the-job training costs. The method will be discussed in Chapter IV. However, for the sake of simplicity in our example, assume for the present that 10% of John's basic pay was subjectively determined to be of an investment nature, i.e., 10% of his time while filling operational billets was spent in building capabilities for use in future periods. Based on the pay table effective 1 January 1970, this would amount to a total of $3,648 of OJT investment in John.

Post-commissioning investments are posted upon the date of training completion except in the case of OJT investments where they are posted either annually, upon job rotation, or whenever there is a change in basic pay. Again, any discounting procedure to compensate for dollar value changes will be neglected here.

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[10] See for example Becker, G. S., Human Capital, Columbia University Press, New York, 1964.

[11] See WRM 67-52, On-The-Job Training Costs: An Analysis, Arzigan, Simon, June, 1967.

Figure 2 presents a summary of the preceding transactions in the form of an individual account. In order to complete the example without unnecessary complication, amortization periods are assigned without any formal justification at this point. The total investment of $41,330 appearing at the bottom of Figure 2 is referred to as "replacement cost,"[12] i.e., to replace the capabilities and experience John has acquired during his 6 years in the Navy will cost $41,330. In an actual system, this figure would be adjusted to reflect inflationary/deflationary trends.

A computation of John's "book value" (historical costs minus amortization and write-offs) after six years of service is presented in Figure 3a and book value as a function of time is illustrated in Figure 3b. The $22,079 is the total portion of those original investments in John which has not been allocated to any past accounting period as an expense. It is this figure which, at the time of John's resignation, should be recorded as a "turnover loss." Or, put a different way, it is the dollar loss associated with John's resignation. The total under the heading "Write-Offs" ($6,816) represents the unamortized investment which was expensed in June 1964, following

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[12] See Brummet, Flamholz and Pyle, op. cit., p.222.

John's transfer from submarine duty. It is the unamortized investment (Submarine School costs, pay and allowances while at Submarine School and submarine related experience) on which no return was expected due to expected non-utilization of acquired skills.

The magnitude of the Navy's investment in John is impressive. Another interesting way to look at the replacement cost figure is in comparison to the total costs associated with John. The total costs over the six year period are $89,349.[13] We see then from Figure 2 that close to half of the costs associated with John are investments, and from Figure 3a we see that between one fifth and one fourth of those costs remain unamortized at the time of John's resignation resulting in a turnover loss.

John, of course, is only a model individual. If he had become a pilot, for example, his account would have appeared entirely different. But it is the individual accounts which serve as the heart of the h.r.a. system, and thus the reason for so much emphasis on a particular example.

An individual account, however, provides little if any useful information to the top level manager concerned

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[13]See WOS 71-4, op. cit., pp. A-28,29.

with retention. It is through aggregation or summation of these individual accounts that meaningful information can be extracted from the system. For example, by summing individual turnover losses over particular officer populations (e.g., submarine qualified officers, pilots, a group working under an experimental policy, etc.) a new measure of turnover is achieved. Where only absolute quantities, rates and percentages are presently available, the dollar cost would be introduced.

However, before discussing the details of an h.r.a. system to support such information needs, it is necessary to cover some implications of decision theory on h.r.a. system design. This is the subject of the next chapter.

INDIVIDUAL ACCOUNT FOR JOHN JONES

DATE	FUNCTIONAL ACCOUNT	AMOUNT	AMORT. PER.
	Pre-Commissioning Investments		
Jun 70	Procurement	$ 50	20 yrs.
Jun 70	Accession Travel	658	20 yrs.
Jun 70	Training	7,425	20 yrs.
Jun 70	Pay and Allowances	4,161	20 yrs
	Total Pre-Commissioning	$12,294	
	Post-Commissioning Investments		
	Training		
Dec 70	Submarine	2,779	15 yrs.
Dec 71	Nuclear Power	6,642	15 yrs.
Aug 74	NBC Defence (Afloat	393	4 yrs.
Sep 74	Radiographic Safety Officer	339	4 yrs.
	Pay and Allowances (during training)		
Dec 70	Submarine	3,641	15 yrs.
Dec 71	Nuclear Power	7,637	15 yrs.
Aug 74	NBC Defence (Afloat)	1,165	4 yrs.
Sep 74	Radiographic Safety Officer	466	4 yrs.
	Job Rotation, Experience and OJT		
Jun 72	Nuclear Submarine - General	292	10 yrs.
Jun 73	Nuclear Submarine - General	693	10 yrs.
Jun 74	Nuclear Submarine - Engineering	869	10 yrs.
Jun 75	Nuclear Surface - General	832	10 yrs.
Jun 76	Nuclear Surface - Engineering	962	10 yrs.
	Job Rotation and Training Travel		
Dec 71	Training to First Duty Station	1,035	3 yrs.
Jun 74	First to Second Duty Station	1,291	3 yrs.
	Total Post-Commissioning	$29,036	
	Six Year TOTAL	$41,330	

Figure 2

COMPUTATION OF "BOOK VALUE" AFTER SIX YEARS OF SERVICE

FUNCTIONAL ACCOUNT	AMOUNT	- AMORTIZATION	- WRITE OFFS	= BOOK VALUE
Pre-Commissioning Investments	12,294	- 12,294*6/20		= 8,615
Post-Commissioning Investments				
Training				
Submarine	2,779	- 2,779*3.5/15	- 2,127	= 0
Nuclear Power	6,642	- 6,642*4.5/15		= 4,650
NBC Defence (Afloat)	393	- 393*1.83/4		= 213
Radiographic Safety Officer	339	- 339*1.75/4		= 191
Pay and Allowances (during training)				
Submarine	3,641	- 3,641*315/15	- 2,790	= 0
Nuclear Power	7,647	- 7,637*4.5/15		= 5,345
NBC Defence (Afloat)	1,165	- 1,165*1.83/4		632
Radiographic Safety Officer	466	- 466*1.75/4		262
Job Rotation, Experience and OJT				
Nuclear Submarine - General	292	- 292*2.0/10	- 234	= 0
Nuclear Submarine - General	693	- 693*1.0/10	- 624	= 0
Nuclear Submarine - Engineering	869	- 869*0.0.10	- 869	= 0
Nuclear Surface - General	832	- 832*1.0/10		= 749
Nuclear Surface - Engineering	962	- 962*0.0/10		= 962
Job Rotation and Training Travel				
Training to first Duty Station	1,035	- 1,035*2.5/3	- 172	= 0
First to Second Duty Station	1,291	- 1,291*2.0/3		= 430
TOTALS	$41,330	12,435	6,816	22,079

Figure 3a

"BOOK VALUE" AS A FUNCTION OF TIME

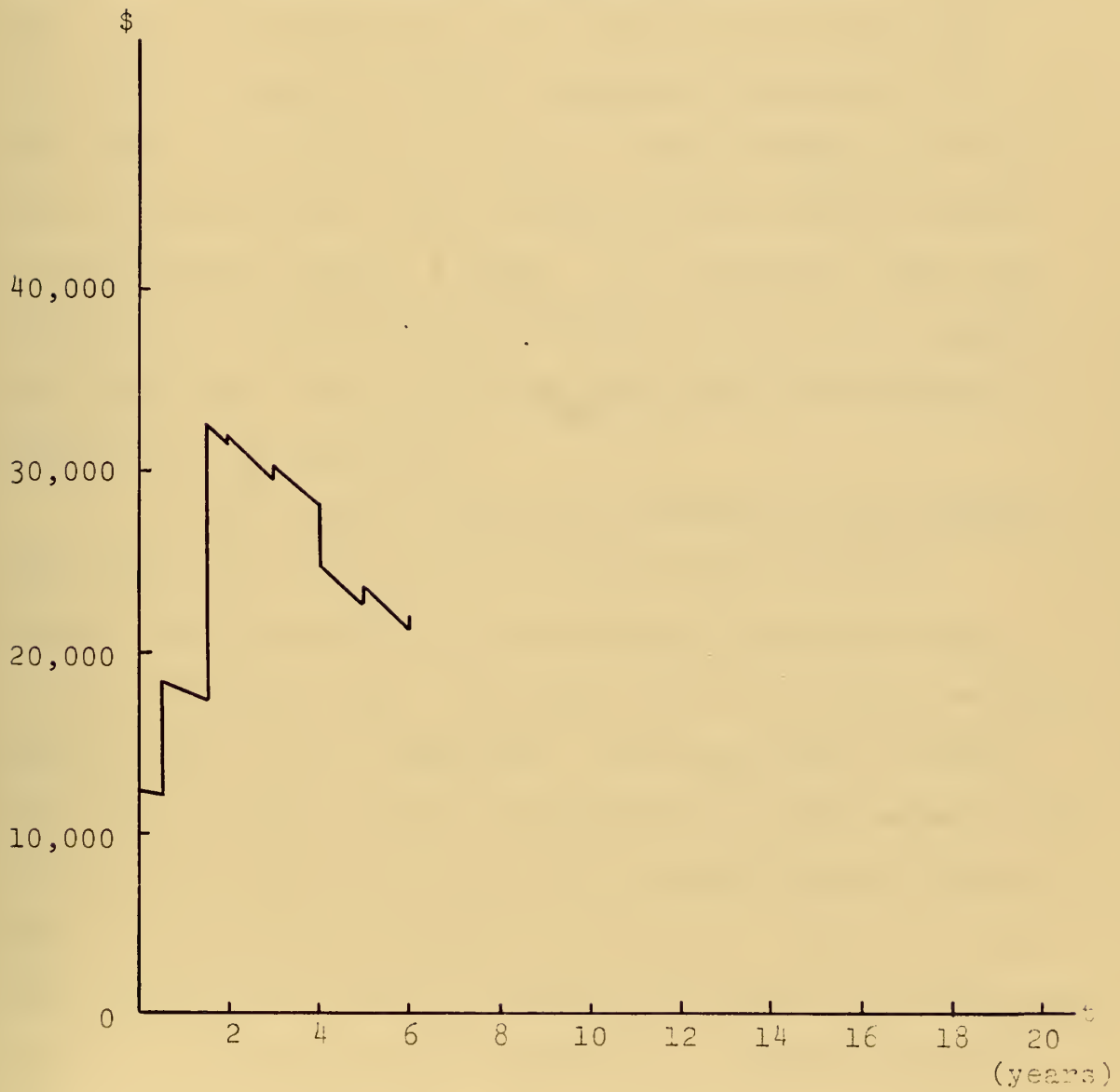

Figure 3b

III. THE INFLUENCE OF DECISION THEORY ON H.R.A. SYSTEM DESIGN

A. OVERVIEW:

Knowledge that an organization's human element is representative of a large investment, and that this investment can be accounted for is of little value unless that knowledge in some way affects managerial beghavior and decisions. In order for h.r.a. to affect managerial decisions, it must play a role in the decision making process or planning and control system. It is important that any organization considering installation of an h.r.a. system understand what that role is and what level of decision making is to be supported.

First, unless the role is defined, it is doubtful that the system output will be beneficially utilized. Second, characteristics of the resulting system will be strongly dependent upon the nature and level of the decision making which is to be supported. William Pyle, a strong proponent of human resource accounting, is often asked, "How can our firm apply the principles of human resource acccunting?" He generally recommends that initial system development efforts be focused on a specific personnel problem which is of major concern to top management. Turnover analysis, absenteeism, reorganization, and manpower planning, for example, often present excellent initial application opportunities within a firm. He further claims that once a

useful application is demonstrated on a small scale to an organization's top management, it will be much easier to develop other applications.[14] But the most important result of Pyle's recommendation is that system analysts, by focusing on a particular problem or decision area, not only must define what decision levels are involved, but are forced to seek answers to questions such as the following: Can system output assist in problem recognition and definition? Can it be helpful in generating and evaluating alternative solutions? Can the results achieved under a chosen alternative be reported or evaluated? And by answering these questions and others like them, and designing the h.r.a. system on the basis of those answers, the role of the system in the decision process and the level of that decision process are defined.

However, before one can understand where and how an h.r.a. system "fits in" he must have an understanding of planning and control. Since analysts of managerial functions have sponsored a multitude of views in regard to planning and control, it is necessary to build a common framework through which our analysis may proceed.

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[14] See Pyle, W. C., "New Perspectives on Managing Human Resources," AMA 42nd Annual Personnel Conference, New York, Feb. 9, 1971.

B. A PROPOSED FRAMEWORK:

1. Planning and Control:

Planning and control are almost always listed as functions of management by writers on the subject. However, it is generally recognized that there is no distinct separation between the two activities.[15] Brummet, et. al., in support of their claim that human resource information is essential to planning and control functions, utilized a framework suggested by the American Accounting Association in, A Statement of Basic Accounting Theory (1966).[16] (See Figure 4.) Although this framework divides the planning and control cycle into five distinct phases, it still defines no clear boundary between planning and control. In fact, although the figure does not show it, I would also suggest that phase boundaries are also poorly defined.

This breakdown will be useful though for determining the role of h.r.a. in the planning and control process. However, it has a serious shortcoming in that it fails to include the level of decision making.

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[15] See Anthony, Robert N., Planning and Control Systems - A Framework for Analysis, Graduate School of Business Administration, Harvard University, Boston, 1965, p. 129.

[16] Brummet, Flamholz and Pyle, op. cit., p. 219.

THE PLANNING AND CONTROL CYCLE

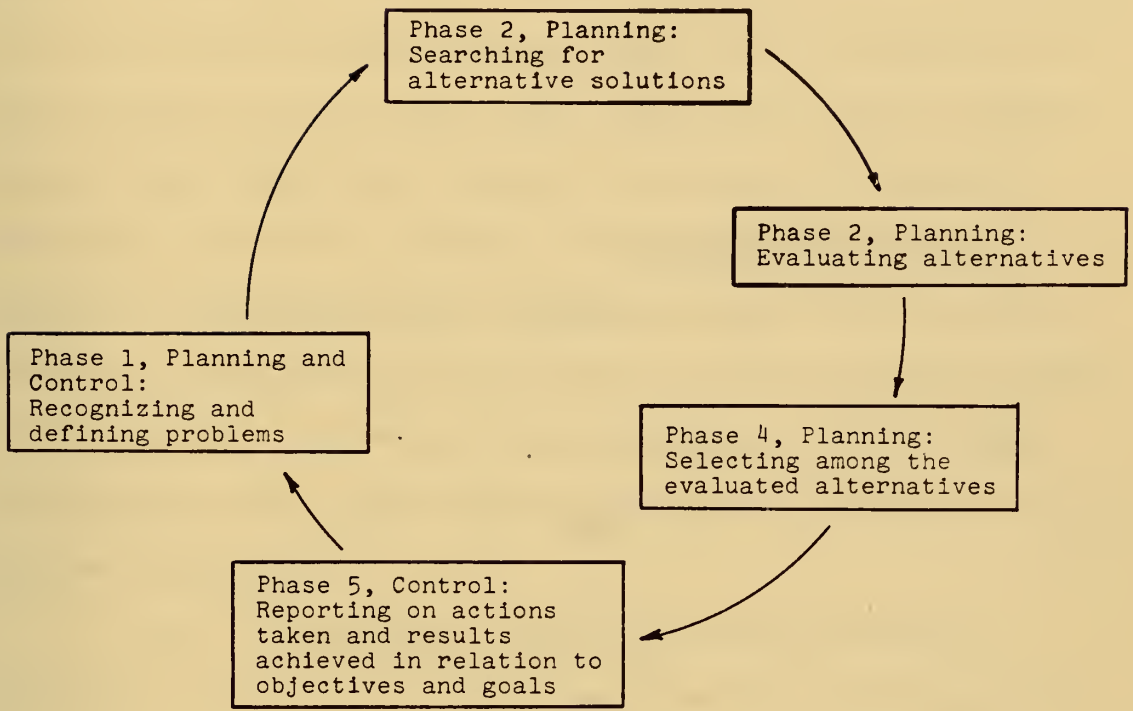

Figure 4

2. Level of Decision Making:

The word "level" in the phrase "level of decision making" generally implies several things about the decision: the importance of the decision, where in an organization the decision will be made, over what time span the consequences will occur, and perhaps the amount of personal judgement involved. Anthony, in Planning and Control Systems - A Framework for Analysis, argues that the differences in decisions implied above require the development of systems with different characteristics. He develops a framework which used three categories of decision making defined as follows:[17]

a. "Strategic planning is the process of deciding on objectives of the organization, on changes in these objectives, on the resources used to attain these objectives, and on the policies that are to govern the acquisition, use and disposition of these resources."

b. "Management control is the process by which managers assure that resources are obtained and used effectively and efficiently in the accomplishment of the organization's objectives."

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[17] Anthony, op. cit., pp. 16, 17, 18.

c. "Operational control is the process of assuring that specific tasks are carried out effectively and efficiently."

The category titles in no way imply that strategic planning does not involve any control, management control does not involve any planning, etc. Nor does Anthony intend to imply that these are precise classifications; as in the case of planning and control phases discussed above, a continuum is again more appropriate.

There are several aspects which are implied, however. The words "strategic planning" are meant to connote big, important plans, plans with major consequences for the organization as a whole. Three key aspects of management control are emphasized: management control involves interpersonal interaction, it takes place within the context of policies and objectives determined by strategic planning, and actions taken are judged by effectiveness and efficiency. Operational control is primarily concerned with tasks rather than people, and since those tasks are specified, little or no judgment is required.

Based on Anthony's framework, Figure 5 can be

constructed.[18] It should be clear from the figure that the characteristics of an information system designed to meet the requirements of strategic planning will be quite different from the characteristics of one designed to support operational control. But before relating the above framework to the design of an h.r.a. system, I would like to present one more viewpoint on the science of decision.

3. Programmed and Nonprogrammed Decisions

H. A. Simon makes a distinction between programmed and nonprogrammed decisions.[19]

a. "Decisions are programmed to the extent that they are repetitive and routine, to the extent that a definite procedure has been worked out for handling

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[18] Gorry, G. Anthony and Scott Morton, Michael S. have developed the same sort of figure in their paper "A Framework for Management Information Systems," Sloan Management Review, Vol. 13, No. 1, Fall, 1971. In fact, this analysis parallels theirs in some respects. Anthony also develops a similar figure.

[19] Simon, H. A., The New Science of Management Decision, Harper and Rowe, New York, 1960, p. 6. Simon also divides the decision making process into three phases; intelligence, design, and choice. It is interesting to note that a correspondence can be drawn between these three phases and the five planning and control phases we have adopted above.

CHARACTERISTICS OF DECISIONS BY DECISION CATEGORY

CHARACTERISTIC	STRATEGIC PLANNING	MANAGEMENT CONTROL	OPERATIONAL CONTROL
Importance	high → → → → → → → → → →		low
Where made in organization	top level → → → → → → →		lower levels
Impact on organization	widespread → → → → → → →		narrow
Time frame of consequences	long-term → → → → → → →		almost immediate
Amount of judgment	a lot → → → → → → → → → →		little
Frequency of particular problem	seldom → → → → → → → → → →		recurring
Information recency	old → → → → → → → → → →		quite current
Problem definition	widely defined → → → → →		narrowly defined
Accuracy required	low → → → → → → → → → →		high
Aggregation of information	broad coverage → → → → →		detailed

Figure 5

them so that they don't have to be treated de novo each time they occur."

b. "Decisions are nonprogrammed to the extent that they are novel, unstructured, and consequential. There is no cut-and-dried method for handling the problem because it hasn't arisen before, or because its precise nature and structure are elusive or complex, or because it is so important that it deserves a custom-tailored treatment."

Again, it is not intended that the two be divided by a distinct boundry. Gorry and Morton claim that this distinction, though, is a useful one in designing information systems. "Different procedures, different kinds of computation, and different types of information may be required depending on the extent to which the problem in question is unstructured."[20] Additionally, they conclude that it is the nonprogrammed decision areas in which the highest potential for affecting management decisions and improving effectiveness exists.[21]

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[20]Gorry and Scott Morton, op. cit., p. 60. Gorry and Morton use structured and unstructured in place of programmed and nonprogrammed to avoid implying computer dependence.

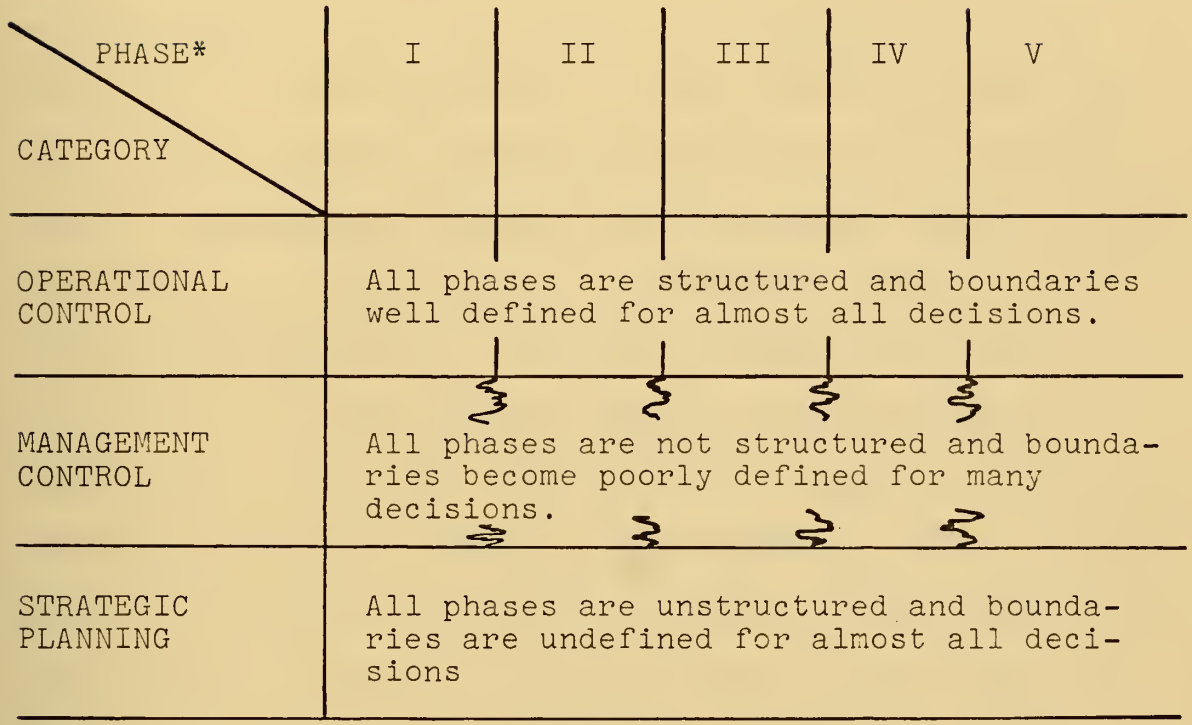
[21]Ibid, p. 14.

4. Integrating the Framework:

The above discussion can be combined to form an integrated framework. When progressing from operational control to management control to strategic planning, the decision process becomes less programmed or more non-programmed. However, in each of Anthony's categories, the decision or planning and control process still exists. The difference in planning and control as we progress from operational control to strategic planning is that the process becomes less defined. Phases become less structured and phase boundries become more obscure. An attempt to diagram this framework results in Figure 6.

Note that Figure 6 still allows for some programmed decision making at the strategic planning and management control levels, and some nonprogrammed decision making at the operational control level. Also, over time, as management science progresses, a larger set of decision areas which can be called programmed are produced at all levels of decision making.

MANAGEMENT DECISION SYSTEMS FRAMEWORK



* Phase I: Recognizing and defining problems

Phase II: Searching for alternative solutions

Phase III: Evaluating alternatives

Phase IV: Selecting among evaluated alternatives

Phase V: Reporting on actions taken and results achieved in relation to objectives and goals

Figure 6

C. CHARACTERISTICS OF THE H.R.A. SYSTEM BASED ON THE PROPOSED FRAMEWORK:

Although implementation is discussed in Chapter V, two key aspects which influence h.r.a. system characteristics must be mentioned here. First, Anthony argues that "the starting point in construction of the over-all system should be management control, as distinguished from strategic planning, operational control, information handling, or financial accounting."[22] Second, as stated previously, Gorry and Scott Morton argue that the unstructured and semistructured decision areas offer the highest potential for affecting management decisions and improving effectiveness.[23] Based on these two points and the previous discussion within this chapter, a group of characteristics evolve which will be useful in designing a potentially successful system.

Recalling that management control takes place within the context of policies determined by strategic planning, it is not necessary to construct models which support policy determination. On the other hand, the system, like the manager, must be capable of operating within established but varying policy.

Figure 5 clearly shows that none of the char-

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[22] Anthony, op. cit., pp. 113 - 116.

[23] Gorry and Scott Morton, op. cit., pp. 61 - 63.

acteristics of decisions made in management control are extremes: judgment is required, but not as much as strategic planning; the results of decisions are important, but are not as far-reaching as those of strategic planning, etc. Because management control is between extremes, the resulting support system characteristics are more difficult to describe precisely, but several decision characteristics do imply support system characteristics.

Since management control involves interpersonal interaction, such relationships must not be jeopardized by placing the support system between the parties. However, since communication of information is relatively difficult at this decision level, a system which, by providing the proper vehicle, enhanced the parties abilities to understand each other, would be desirable.

Problems are recurring, although not on a day to day basis as in operational control. This implies that a specific set of routines and reports can be planned at the outset. However, the recurring problems are usually not so narrowly defined as in operational control, requiring the ability to modify or construct new routines and reports.

Since the situation changes more rapidly than in strategic planning, it is important that information be relatively current. However, this is achieved only at a

cost, which must be weighed carefully. The level of information aggregation and data accuracy are other characteristics which must be weighed against cost. However, since many problems will require detailed accurate information, data will probably be maintained in that form.

Finally, the degree to which a decision area is unstructured will influence the support system characteristics and the role the system will play in the planning and control cycle. If none of the phases of the planning and control cycle are or can be structured, only data access and useful display can be provided. If the entire planning and control cycle can be considered semistructured, i.e., one or more but not all phases structured, procedures, algorithms or decision rules can be constructed for the structured phases.

Figure 7 summarizes the characteristics developed above for an information system supporting management control decisions. Note that although the general term "information system" is used, the characteristics developed apply just as well to a specific system such as h.r.a.

If Anthony's and Gorry and Scott Morton's theories are both correct, an h.r.a. system designed to support unstructured and semistructured management control decisions would have the highest probability of success if implemented. The characteristics developed above and summarized in Figure

MIS CHARACTERISTICS IMPLIED BY DECISION CHARACTERISTICS
(MANAGEMENT CONTROL)

DECISION CHARACTERISTIC	⟹	MIS CHARACTERISTIC
Within policy	⟹	Policy must be specified
Interpersonal interaction	⟹	System can't act as interface
Difficult communication	⟹	Provide common language
Recurring problems	⟹	Specific routines and reports
Fairly wide problem definition	⟹	Routines and reports easily modified
Situation change	⟹	Current information
Variable detail and accuracy	⟹	Detailed and accurate data base
Degree of structure	⟹	Degree of system processing and decision capability

Figure 7

7 would apply to such a system. I have chosen to accept the theories, and attempted to design an h.r.a. system with the characteristics appearing in Figure 7. Since successful (or unsuccessful) implementation is linked quite closely with adherence to the theories, further explicit discussion will appear in Chapter V (Implementation) rather than the next chapter.

IV. PRELIMINARY SYSTEM DESIGN

A. OVERVIEW

The end result of the previous chapter was a set of desirable characteristics which should serve as guidelines for the design of a potentially successful human resource accounting system. Some of these characteristics should directly affect the analyst's decisions when designing the data base, imput methods and media, and the most elementary processing capabilities, while other desirable system characteristics are more relevant when dealing with the use of the system by the decision maker. The first aspects of system design are discussed in this chapter.

First, a framework is developed for categorizing human resource costs; then a feasible method of getting human resource costs into a usable data base is covered. Two of the characteristics summarized in Figure 7, current information and detailed and accurate data base, apply directly to this phase of design. Several trade-offs are made within the chapter which tend to affect these characteristics, either favorably or unfavorably. However, the final result is a system which does have a fairly detailed, accurate and current data base.

B. ACTUAL, AVERAGE, AND STANDARD COSTS:

As seen in Chapter II, much of the data input to the h.r.a. system is in the form of historical costs represented by dollars. Some of these costs can be readily and precisely identified on an individual basis. However, in many instances only the total cost for a group of people is known precisely. In this case any individual costs computed will be average costs. In still other cases the historical costs are even less identifiable, as is the situation with on-the-job training and experience investments, which leads to the development of standard costs. Each of these cost categories is further discussed and defined below. Figure 8 summarizes the cost types associated with each functional account.

1. Actual Costs:

Actual costs, for purposes of this study, are defined as those investments made in an individual which can be precisely identified on an individual basis. Although formal mechanisms do not presently exist for entry of this data into the h.r.a. system, actual costs themselves do exist and are identifiable. Using the model presented in Figure 1 and the discussion of functional accounts in Chapter II, accounts within which actual costs can be used are easily identified.

Starting with the group of pre-commissioning

SUMMARY OF COST TYPES ASSOCIATED WITH EACH FUNCTIONAL ACCOUNT

FUNCTIONAL ACCOUNT	COST TYPE
Pre-Commissioning Investments	
Procurement	Average
Training	Average and Actual
Accession Travel	Actual
Post-Commissioning Investments	
Training	Average
Pay and Allowances	Actual
Job Rotation, Experience and OJT	Standard
Job Rotation and Training Travel	Actual

Figure 8

functional accounts, some training costs can be identified on an individual basis. John Jones, in the example in Chapter II, obtained his commission through the NROTC-R program. Some costs associated with John's pre-commissioning training can be conveniently reported as they pertain to John alone. Tuition and fees are paid by the Navy in John's behalf. An accounting and disbursing system exists to handle payment of these costs. They are also known to the individual NROTC administrative units. Either activity could serve as a data source for the h.r.a. system input.

Any accession travel is also identifiable as an actual cost. Each time a travel order is executed, costs which are unique to the particular individual are incurred. Again, a system exists which handles travel payments and can be tapped for h.r.a. system input.

Pay and allowances received prior to commissioning are the last actual costs under the pre-commissioning classification. Since payments are made by the disbursing offices at established rates, either that system or a table within the h.r.a. system could provide the necessary pay and allowance information.

Progressing to post-commissioning investments, the pay and allowances disbursed while an officer is in formal training status are identifiable, and h.r.a. system input can be handled in the manner of pre-commissioning pay and

allowances. Pay and allowances disbursed while an officer is in formal training status are therefore considered actual costs. Costs associated with job rotation and training travel are the other category of actual post-commissioning costs. As in the case of pre-commissioning travel, a system exists which handles the accounting and payment of these costs and could be relied upon for h.r.a. system cost input.

2. Average Costs:

Average costs are defined as those investments which are identifiable only over a group of individuals. Those costs used in the example in Chapter II which were taken from WOS 71-4 were average costs. For example, the pre-commissioning investment recorded is an average over all those officers achieving their commissions through NROTC-R programs. However, we now understand that some of those costs, e.g., tuition, can be more precisely identified as actual costs. But actual cost per individual is often impossible to determine, thus the need for additional cost types, including average costs.

Procurement is one cost which can only be identified as an average over a group of successful candidates. This average is presently being calculated by a Bureau of Personnel division and is available for use by the h.r.a. system.

Some costs are involved in pre-commissioning

training which can only be calculated on an average cost basis. The cost per student of operating the Naval Academy, for example, is calculated by dividing total operating costs by total students (an oversimplification for purposes of illustration to be covered in detail later). Likewise, even though John Jones attended a civilian university or college, tuition and fees were not the only costs involved. The average cost per student for operating the NROTC unit must also be applied to his account.

Post-commissioning training investments are also, at the most, only identifiable by average costs. The same calculation procedure exists as for the Naval Academy case above.

3. Standard Costs:

There is still another category in the cost hierarchy called standard costs. Standard costs are defined as costs which are known to exist but cannot be identified by measuring directly any known dollar flow. Although several other terms could be used to describe these costs, e.g., imputed or implicit cost, I shall continue to use the terminology "standard costs." Within the framework of this study standard costs are only associated with the post-commissioning functional account of Job Rotation, Experience and OJT. Since standard costs are so difficult to identify, one tempting alternative might be to neglect them. However,

the literature is in general agreement that such costs have considerable magnitudes. In fact, the management of one company which pioneered in human resource accounting found that OJT, experience, and familiarization investments are of major importance.[24] Having decided to include the standard costs associated with job rotation, experience and OJT, a means of determining the standard must be developed. Alternatives can range from a subjective judgment to the detailed measurement of other variables, e.g., the time spent in OJT. A feasible method is presented in the following section of this chapter.

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[24]See Woodruff, R. L. Jr., "Human Resource A Accounting," Canadian Chartered Accountant, September, 1970.

C. INPUT - A FEASIBLE METHOD:

1. Overview:

The previous section discussed cost types as though they were to be reported directly from the cost center on an individual basis. However, the reporting system required to account for 70,000 officers by such a method would be extremely cumbersome. Therefore, although some accuracy may have to be sacrificed, a more practical system is desirable. This section presents such an input system.

Any time an officer has a major change of job status, a written order precedes and documents the transaction. Similiar documentation exists when an officer is commissioned and whenever his rank changes. If the h.r.a. system could be designed to use orders as the indication of an investment, little administrative burden would be placed on individual commands or cost centers. Such an approach requires supporting cost files. But in this manner, when an order which indicates an investment is received, the administrative burden of looking up the costs and amortization periods involved is delegated to the automated features of the system. The supporting cost files and the data input to those files are discussed next.

2. Procurement Investment File:

This file contains average procurement costs

which are presently determined on the basis of program by the Bureau of Naval Personnel (Pers-B6). Chapter II discussed costs attributable to officer procurement. Procurement investments are calculated by the information source (Pers-B6) from the following relationship:

$$IP(j) = (CR(j) + CI(j))/N(j)$$

where: $IP(j)$ = Per capita procurement investment for program j

$CR(j)$ = Total yearly recruiting costs for program j

$CI(j)$ = Total yearly induction costs for program j

$N(j)$ = Number of successful candidates in year for program j

It is worth noting at this point that it is relatively unimportant to system design as to who performs the actual calculations implied by the equations presented here, the system or the information source. If, in the case of procurement, IP(j)'s alone are reported, only a simple file update need be performed; if CR(j), CI(j) and N(j) are reported, the file update subroutine must include the calculation precedure, i.e., the above formula.

Since procurement costs, as well as other costs, are subject to change, their calculation is not a one-time event, but a recurring one. The proposal here is to review

Procurement costs annually.

See Appendix A for sample file content based on costs currently available.

3. Training Investment File:

This file contains actual and average investments for both pre and post-commissioning training. The information sources in this case are ultimately the schools and administrative units where training is accomplished. Again, a reporting system exists to obtain training costs. Appendix B contains the report format (with instructions) currently used by the Navy in obtaining such costs. The following relationship determines per capita training investments:

$$IT(j,k) = [(CP(j) + CS(j) + CO(j) + CA(j)) \cdot NW(k) / \sum_k NG(k) \cdot NW(k)] + CT(j,k)$$

where: $IT(j,k)$ = Per capita training investment for cost center j, course k

$CP(j)$ = Yearly personnel cost at cost center j (student salaries excluded)

$CS(j)$ = Yearly consumable supplies cost at cost center j

$CO(j)$ = Yearly operation, maintenance and overhead costs at cost center j

$CA(j)$ = Yearly building and equipment amortization at cost center j (or rental)

NG(k) = Number of course k graduates per year

NW(k) = Number of weeks in course k

CT(j,k) = Cost of tuition and fees for course k at cost center j

Verbally, the equation divides the total cost of a school or cost center within a school by the total number of student weeks of instruction associated with the number of graduates, multiplies the result by the number of weeks in a particular course, adds tuition and fee costs, if any, to obtain the investments per student for that particular course operated by that particular school or cost center.

The reader will note that the terms used in the above equation do not follow precisely the format used in Appendix B. However, all cost items in Appendix B are included in the equation. Appendix B is simply a more detailed version designed with the completing organization in mind. It does not include, however, the amortization item as does the above equation. This is because no depreciation procedure has been established for Navy owned buildings and equipment. Although it is beyond the scope of this thesis, such a procedure could conceivably be established. Any figures used in this thesis then, will not include the amortization of buildings and equipment used for training purposes, i.e., CA(j) =0.

Other features of the equation deserve explanation also. Many schools have a large variety of courses offered. It is often impossible or extremely impractical to assign a particular cost to a particular course, e.g., an instructor may devote his time to more than one course, an item of equipment may be used in more than one course. However, circumstances may permit the grouping of similiar courses to which the assignment of costs becomes more realistic. I refer to such groupings as "cost centers." In some instances, the cost center may be the entire school, whereas in others there may be several cost centers within one school. The point is to be as accurate as possible without unnecessary complication.

The tuition term is necessary to make the equation general. In cases where a Navy operated school is attended, CT(j,k) =0. However, where civilian institutions are used, the actual tuition and fees involved must be included.

As in the case of procurement, the training investment file should be revised or updated annually.

See Appendix A for sample file content based on costs currently available.

4. Pay and Allowances File:

This file is merely a copy of the standard military pay tables which contain monthly rates of pay

and allowances. The file consists of thirteen different categories or types of pay as follows:

B(i,j) = Basic Pay

T(i,j) = Federal Insurance Contribution

S = Subsistence Allowance

Q(i,k) = Quarters Allowance

H = Hostile Fire Pay

P = Special Pay for Physicians and Dentists

G = Diving Duty Pay

J(i) = Aviation Pay

K(i) = Submarine Pay

L(i) = Flight Deck Pay

D = Other Incentive Pay

F = Family Separation Allowance

C = Uniform Allowance

Subscripted variables indicate that the rate of those categories are functions of other variables and are stored in a one or two dimensional matrix as necessary. Subscript "i" indicates dependency upon pay-grade; "j" indicates dependency upon time in service; "k" indicates dependency upon number of dependents, e.g., wife, children, etc. Otherwise, an officer or prospective officer will receive a particular category of pay or allowance depending upon his specialty, his actual job or location, his marital

status, or a combination of these factors.

There is a notable difference between this file and the ones previously discussed which deserves some clarification. This file is not a collection of per capita costs as was the case for previously discussed files. Those files were made up largely of average costs (with the exception of tuition costs) which could be determined very simply by either the information source or an h.r.a. system subroutine so long as cost components were available. In addition, they could be calculated only once per year and not create serious data inaccuracies. However, in this case, where actual costs which depend upon a variety of variables are involved, the most practical approach is to maintain the file in the form of rates as set forth above, and use the h.r.a. system itself to compute the investment figure whenever a transaction occurs.

The reader might argue that the resulting investment figure calculated by the h.r.a. system in this manner is not necessarily the actual amount invested, and therefore the disbursing system which handles the actual payments should be relied upon for input. The argument is well founded, but unfortunately the proposed alternative is impractical due to delays which would be experienced with an overburdened reporting system. In addition, there is little need to demand pay and allowance figures

accurate to the penny when grosser errors exist in per capita investment figures. When adding a group of figures, it does no good to calculate one to the fourth decimal place when all the others are accurate only to the first since the answer is still only accurate to the first decimal place.

Perhaps this is a good place to clarify another question concerning actual costs. Two important features of an information system are the timeliness of information produced and the verifiability of that information. As discussed above, by using the h.r.a. system to calculate "actual" costs, rather than waiting for them to filter through a reporting system, timeliness is improved. However, the "real" actual costs still exist against which the calculated actual costs can be periodically verified. If an unacceptable discrepancy exists, the calculation procedure must be modified.

This file would be revised whenever necessary, i.e., whenever new rates were determined.

See Appendix A for a sample file content based on current pay rates.

5. Travel Files:

These files contain information necessary to calculate accession travel and job rotation and training travel investments. Recall that these were catagorized as actual costs, and the argument about timeliness and

verifiability applies here also.

There are three specific cases in which travel costs should be considered investments. Two involve a permanent change of station where the officer is either ordered to a new operational job or to a school as a student. The other involves only a temporary change of duty where the officer is sent to a school (typically of short duration) and returns to his more permanent job. This differentiation is necessary partially because of the different costs involved and partially due to the need for information which differentiates job rotation and training investments.

In either case, total individual travel cost will be the sum of two of three components, and can be described as follows:

$$PCS = (a+b \cdot d)S(k,m) + C(i,j) \cdot S(k,m)$$

$$TCS = a \cdot S(k,m) + P(n) \cdot L$$

where: PCS = total travel investment for permanent change of station

a = mileage rate for officer [$/mile]

b = mileage rate for dependent [$/mile]

d = number of dependents

TCS = total travel investment for temporary change of station

C(i,j) = Moving rate [$/mile] dependent upon rank "i" and number dependents "j"

S(k,m) = mileage between points "k" and "m"

P(n) = per diem rate for area [$/day]

L = length of time in days at temporary station

C(i,j), S(k,m) and P(n) are the quantities stored in so called travel files. Parameters "a" and "b" are constants, "d" is carried in the individual's account or record, and "L" is indicated by the travel order initiation the transaction. Clearly, travel costs calculated through the above formulae will rarely agree precisely with the actual dollars disbursed in payment of those costs. However, as pointed out when discussing pay and allowances, the delays experienced in obtaining precise data can be tremendous (in the case of travel costs, often over six months as reported by a Bureau of Personnel official involved in gathering such information). Again though, the calculation method is verifiable, and undersirably large discrepancies call for modification of the coefficients or procedures.

These files should be reviewed and revised as necessary but never less often than annually.

6. Job Rotation, Experience, and OJT Investment Calculation:

As pointed out previously, costs related to this functional account are the most difficult ones to identify. The R. G. Barry Corp. was the first to install a human resource accounting system which included on-the-job training and experience investments. Their experience is by no means the first attempt to calculate on-the-job training and experience related investments. However, having admitted to their importance, my intent here is not to conduct a general review of the literature, but to present a specific method for estimating the more important of these investments.

By far the most common method of calculating OJT and experience related investments involves some measurement of individual time involved in these activities. The measurements might be taken over the entire population for which investment figures are desired or a representative sample of that population. In the case of R. G. Barry Corp., certain positions were studied, and standards were developed and extended to cover all positions. However, this approach appears financially infeasible for a large organization such as the Navy unless only a very small portion of the total population were to be included in the system. Therefore, the attempt here is to develop a procedure for estimating these investments which is feasible and relatively free of field studies and reporting systems except for verification purposes.

The following deductive approach is offered.

If an officer were commissioned without any initial training, e.g., directly from high school, his effectiveness would be relatively low compared to today's newly commissioned officers. In fact, it does not seem unrealistic to assume his effectiveness to be zero if such were the case. Specifically then, let us begin by assuming that at the time of beginning pre-commissioning training, the potential officer would be completely unable to perform in an operational job. Furthermore, after completing all pre-commissioning training, the individual is still not 100% effective and spends a portion of his time in on-the-job training. Mincer presented the same sort of argument in a 1962 study: "...formal school instruction is neither an exclusive nor a sufficient method of training the labor force. Graduation from some level of schooling does not signify the completion of a training process. It is usually the end of a more general and preparatory stage, and the beginning of a more specialized and often prolonged process of acquisition of occupational skill, after entry into the labor force. This second stage, training on the job, ranges from formally organized activities such as apprenticeships and other training programs to the informal

processes of learning from experience."[25]

Therefore, at this point, we have reasoned that OJT and experience investments are being made in the newly commissioned officer at a rate yet to be determined. Next, the period of time required for the individual to be able to fully utilize his pre-commissioning training must be determined. Defining such a period for an individual trained in a specific skill is difficult enough, but to define it for officer personnel, whose duties are largely managerial in nature, seems at first glance to be impossible. However, upon closer examination, just as there are indications of amortization period recognition, this learning period following commissioning is also recognized, albeit through policy, in the following manner. When an officer's potential is so low that he is not promoted to Lieutenant (Junior Grade), Lieutenant, or Lieutenant Commander, we can consider, for all practical purposes, that his resignation has been requested or that he will be "fired" at a time the Navy considers desirable. However, once the rank of Lieutenant Commander is reached, the individual, generally speaking, is allowed to continue until retirement (at least 20 years total service)

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[25]See Mincer, Jacob, "On-The-Job Training: Costs Returns, and Some Implications," Journal of Political Economy, Vol. LXX, No. 5, Part 2 (Supplement: October 1962), pp. 50 - 79.

regardless of whether or not future promotions come to pass. What this policy can be construed to say in simplified terms is that once an individual reaches the rank of Lieutenant Commander, the Navy foresees being able to use his developed capabilities regardless of future promotions. On the other hand, if the individual fails to attain that rank, his abilities have not been developed sufficiently to provide a reasonable probability of useful service until he is elligible for retirement. Therefore, having already admitted to a large portion of capabilities being developed outside of a formal training environment, i.e., on the job, we are provided with a rough indication of the OJT period following commissioning: the time required to reach the rank of Lieutenant Commander. Although this period varies over time, its present value is close to nine years. For calculation purposes, this study will assume the nine year value.

However, during this OJT period, an individual is not only learning, but is also performing jobs which are currently useful. Thus, while a portion of his pay and allowances can be considered investments for which future contributions are desired, the remainder must be considered a current expense in payment for current contributions. In order to estimate this ratio, the liter-

ature concerning learning was consulted.[26] One result of learning theory is the learning curve. Learning curves result when some measure of performance is plotted against time or the number of trials at practice.

Such graphs, when averaged over a number of subjects, are smooth and regular, even though an individual learning curve may be irregular. This regularity suggests the existence of some mathematical relationship between the variables; in this case, time and performance. Researchers have suggested a variety of different relationships, some being derived through theory, and others by mathematical fit of experimental data.[27] However, an exponential provides a reasonably good description of most curves appearing in the literature, suggesting the following relationship:

$$CP = 1 - e^{-t/\tau}$$

where: CP = current proficiency in decimal terms (with a maximum of 1.00)

e = 2.71828

t = time

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[26] See for example, Deese, James and Hulse, Stewart H., The Psychology of Learning, New York, McGraw Hill, 1967.

[27] Ibid., pp. 331 - 339.

τ = time constant or time required to reach 63.213% proficiency

Figure 9 illustrates such an exponential curve with $\tau = 1.00$. It is apparent that the curve in Figure 9 never actually reaches its asymptote of 1.00, but only comes infinitesimally close as $t \to \infty$. However, in terms of time constants, the approach to the asymptote is fairly rapid. In fact, at $t = 4$, CP = 0.982. For practical purposes then, we can consider an individual to be 100% proficient at 4τ after beginning training.

Figure 10a shows the theoretical learning curve as it applies to individuals abtaining their commissions through four year programs such as NROTC or Naval Academy. In this case $\tau = (4 + 9)/4 = 3.25$ years (time of learning prior to commissioning plus average time to Lieutenant Commander, all divided by four). The initial phases of learning take place in this instance during the four years prior to commissioning in a formal training atmosphere. But since formal training investments are made at a rate independent of the learning curve, we are only interested in that portion of the curve which takes place on the job, i.e., following commissioning.

If the learning curve is inverted as in Figure 10b, the ordinates provide a measure of the portion of an individual's pay and allowances which should be considered

EXPONENTIAL CURVE: $1 - e^{-t/\tau}$

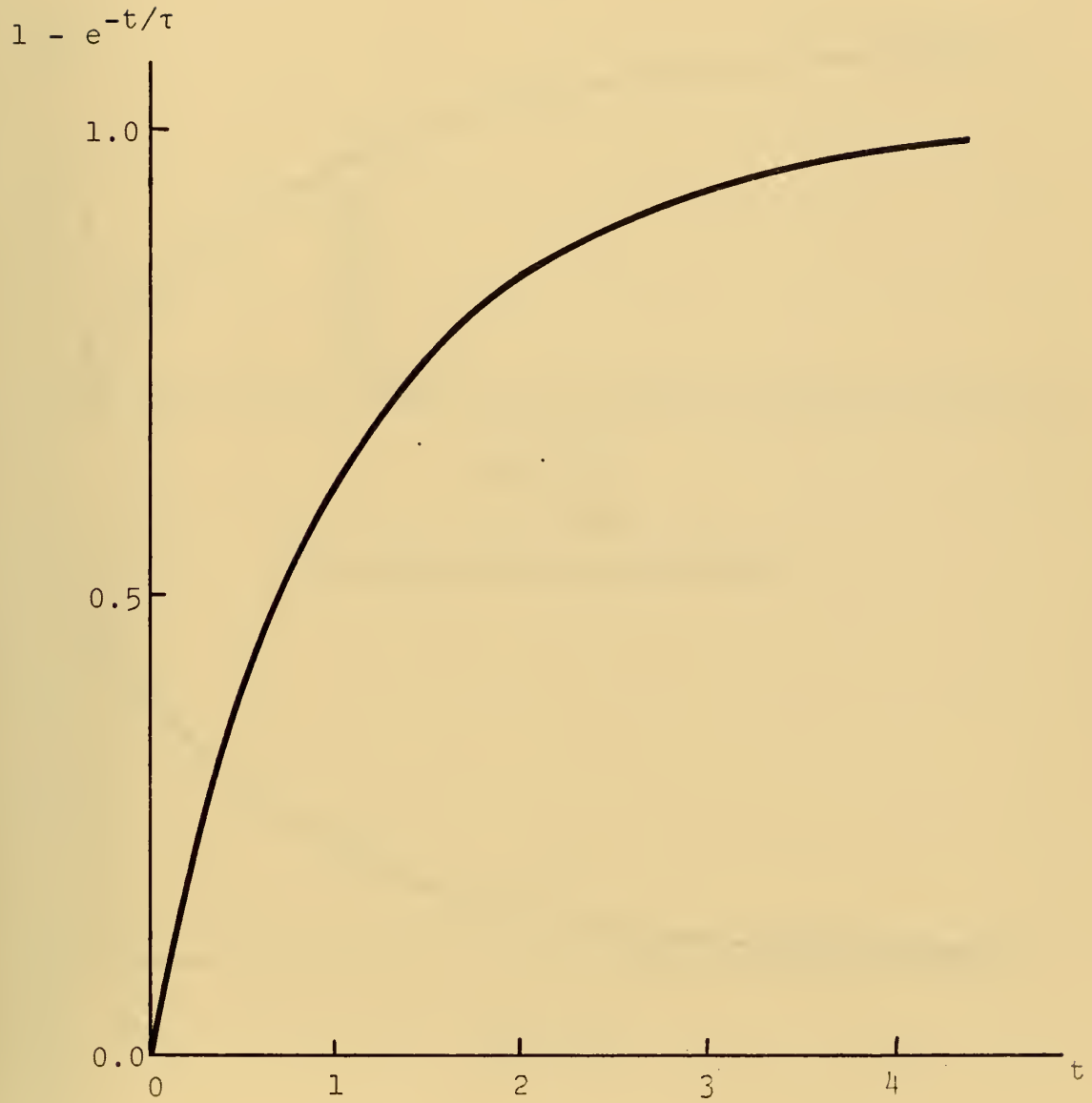


Figure 9

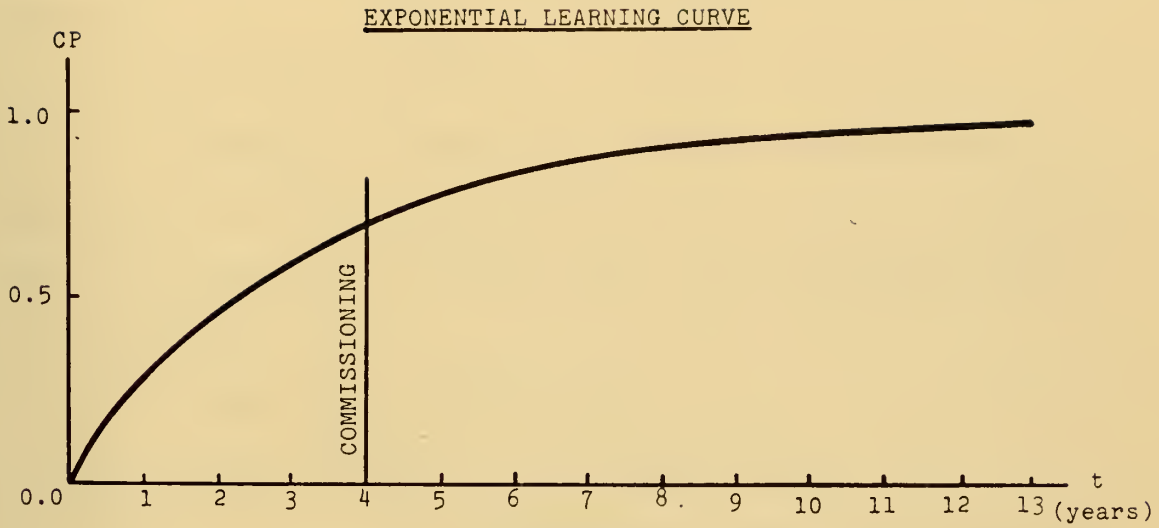


Figure 10a

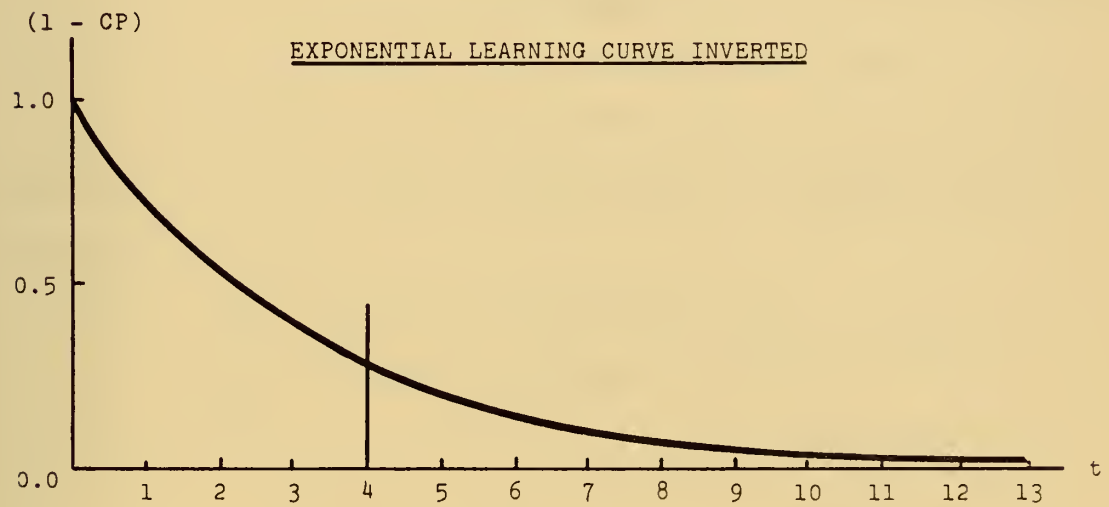


Figure 10b

investments. This curve is described by the following equation:

$$(1 - CP) = e^{-t/\tau}$$

Finally, if pay and allowances are reduced to a function of time and multiplied by (1 - CP), the investment rate is obtained as in Figure 11a - c. The relationship is as follows:

$$OJTIR = TP \cdot e^{-t/\tau}$$

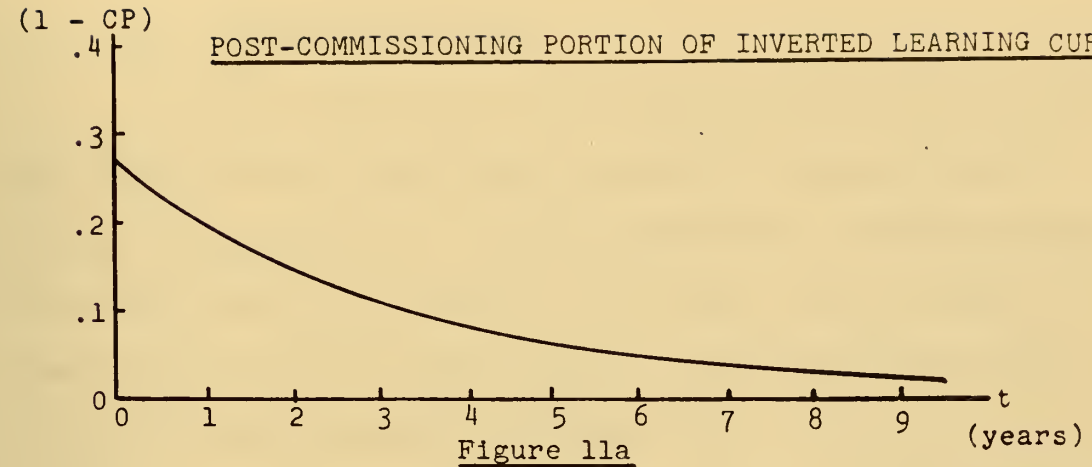
where: OJTIR = investment rate for OJT

TP = summation of pay and allowances individual is receiving (expressed as a function of time)

The total OJT investment to be recorded at any discrete point in time is determined by integrating the investment rate:

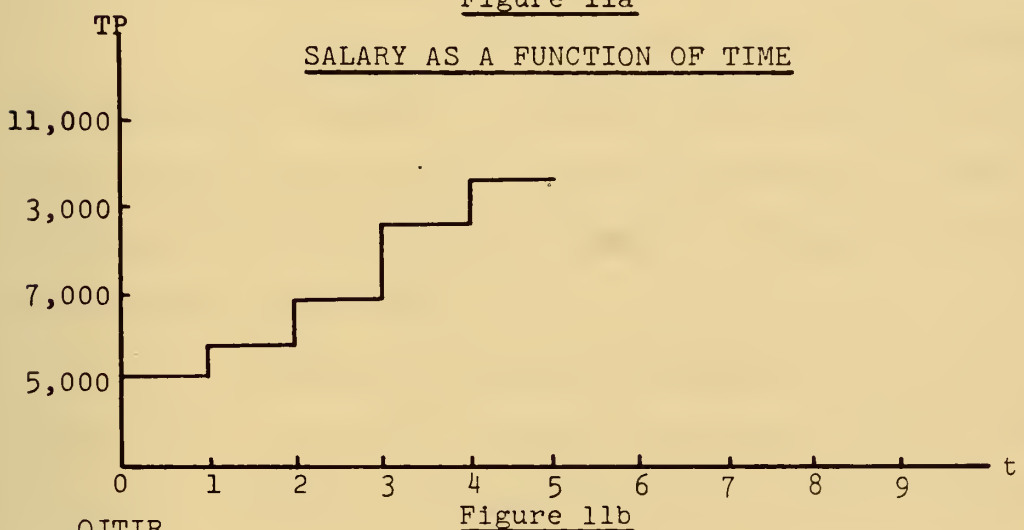
$$OJTI = \int_0^T OJTIR \, dt = \int_0^T TP \cdot e^{-t/} \, dt$$

where: OJT = investment for OJT



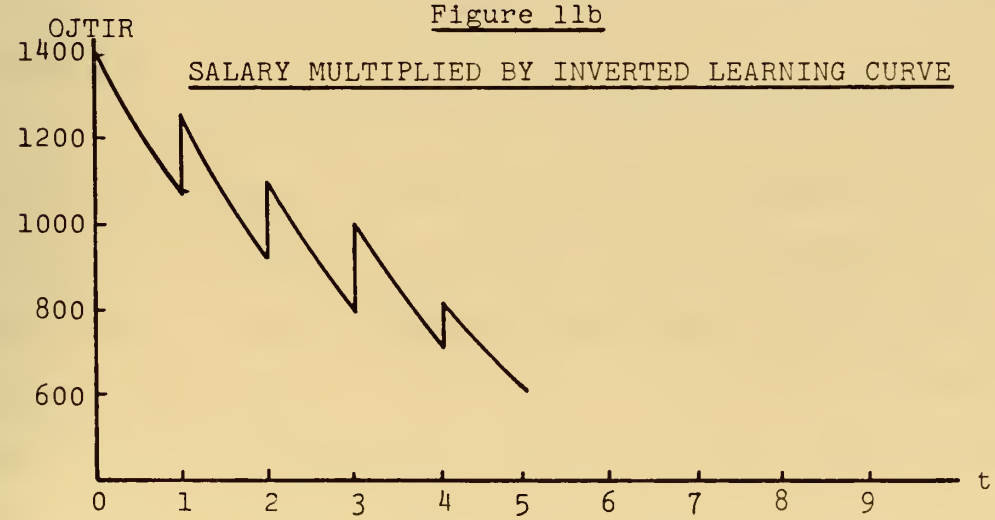
POST-COMMISSIONING PORTION OF INVERTED LEARNING CURVE

Figure 11a



SALARY AS A FUNCTION OF TIME

Figure 11b



SALARY MULTIPLIED BY INVERTED LEARNING CURVE

Figure 11b

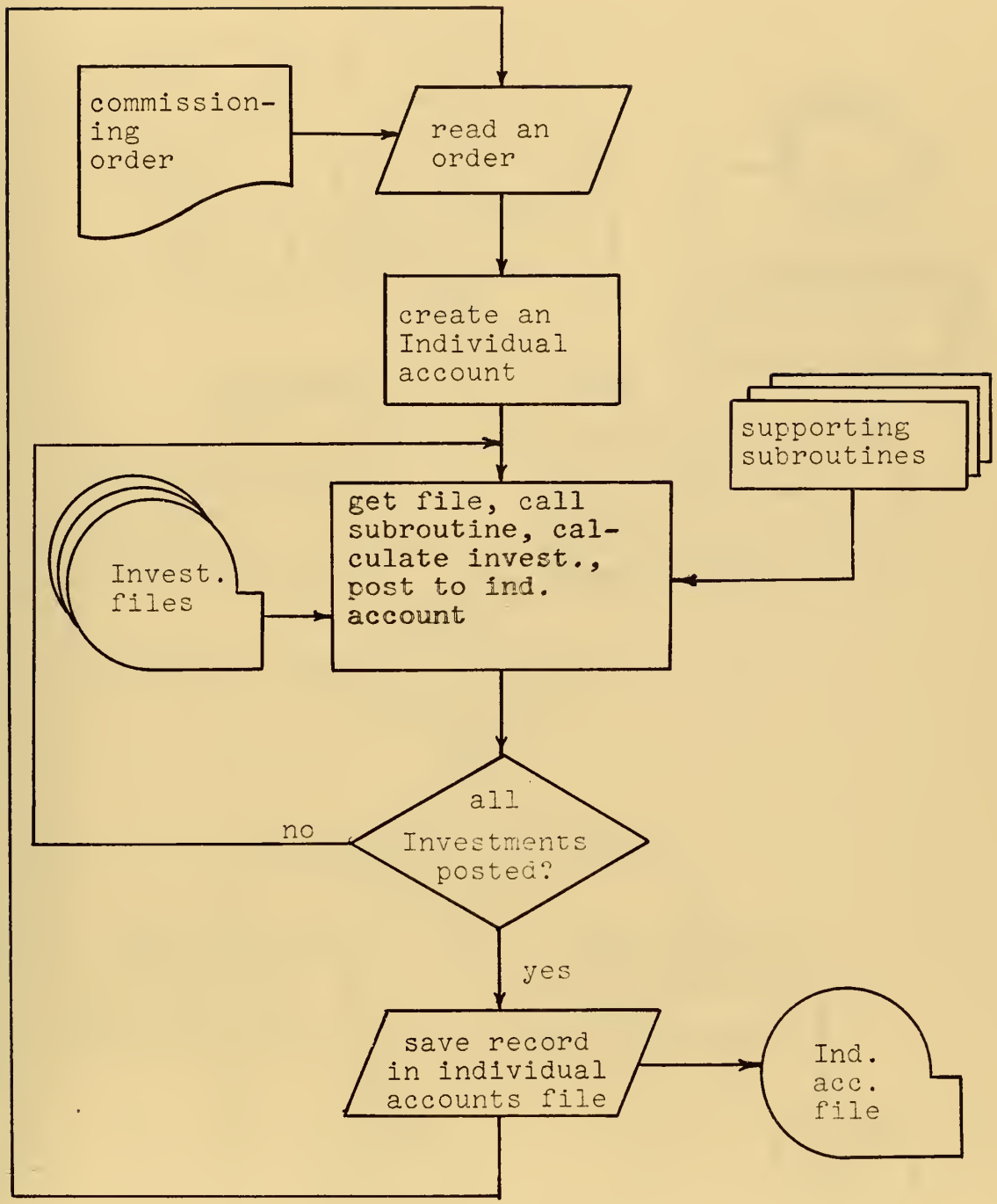
D. BASIC SYSTEM OPERATIONS:

Once supporting cost files and subroutines have been established, individual records or accounts can be created and maintained. Upon an officer's commissioning, an account would be created in his name, and all pre-commissioning investments posted. The macro flow chart for this routine appears in Figure 12.

The individual account file must be maintained. This requires a simple file update when documents indicating a change are received. Change documents include both investment and write-off indications. Figure 13 shows one possible procedure.

Accounts are amortized regularly (at least on a yearly basis), but the original investment figures are retained. Figure 14 presents an overall view of this procedure.

All other routines and data manipulations are performed because information output in support of a decision is desired. I pointed out in Chapter III that the nature of the decision itself will determine the role of systems support. This role in turn will determine the specific data manipulation procedures and output content. The probability of successful implementation is strongly dependent upon the system's ability to furnish information consistent with the decision being supported.



INDIVIDUAL ACCOUNT CREATION PROCEDURE

Figure 12

UPDATE PROCEDURE

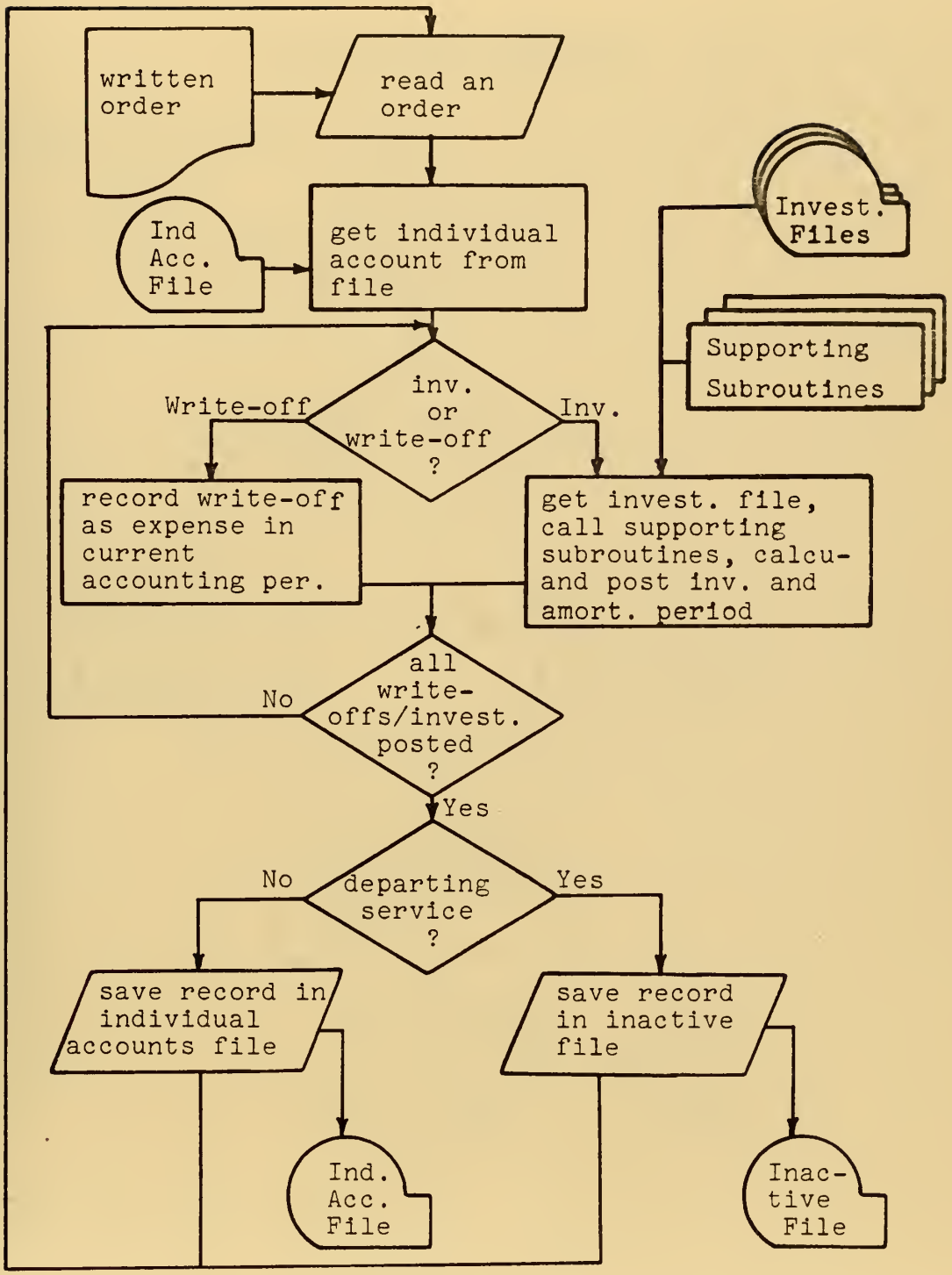


Figure 13

AMORTIZATION PROCEDURE

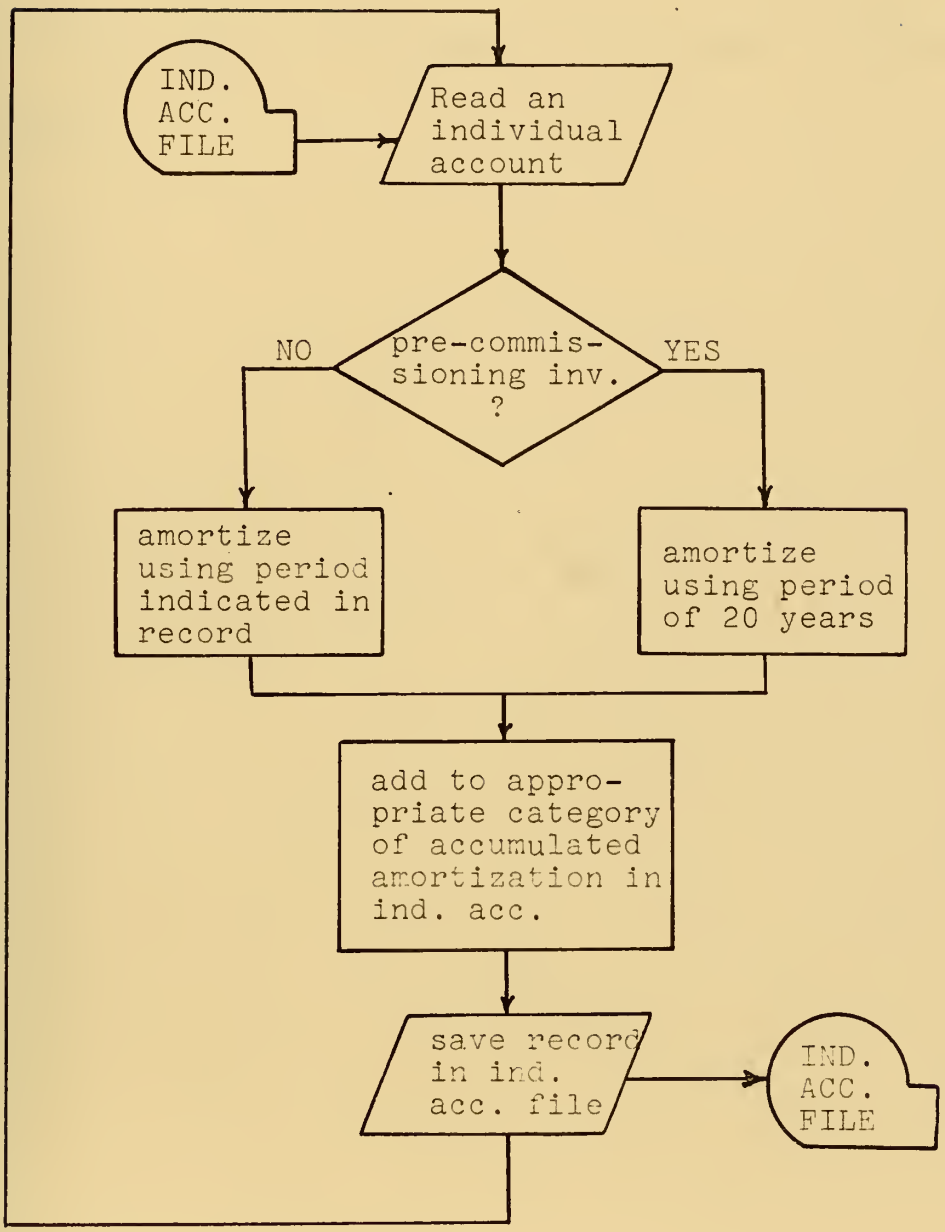


Figure 14

Therefore, since system capabilities with regard to information processing and output are so closely linked to implementation, they will be discussed in the next chapter.

V. IMPLEMENTATION

A. OVERVIEW:

A set of desirable system characteristics was presented in Chapter III, two of which applied to the most fundamental parts of the system as developed in Chapter IV. Most of the remaining characteristics apply to the design of the interface between the h.r.a. system and the user, i.e., processing capabilities and output. If the theory presented in Chapter III is considered valid, we must conclude that successful implementation is highly dependent upon the analyst's ability to design a system which those characteristics closely describe. Additionally, in order to obtain a good perspective on the potential application of h.r.a. systems support, it is essential that a model of the decision process be constructed prior to systems design[28] (by "systems design," I mean processing capabilities and output). As pointed out in Chapter I, a human resource accounting system has the potential to support a wide variety of plans and decisions. Modeling the decision process requires intensive interaction between the analyst and the decision maker. Due to time, geographical and monetary constraints, such interaction for a variety of decision areas is beyond the scope of this

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[28] See Gorry and Scott Morton, op. cit. pp. 65, 66.

thesis. Consequently, I have chosen to concentrate on only one decision area, but in so doing, apply the results of Chapter III and use the fundamental parts of the system developed in Chapter IV.

B. MODELING AN EXAMPLE DECISION AREA:

The primary considerations in selecting a decision area for h.r.a. system support were: (1) that it must fall into the management control category as discussed in Chapter III, and (2) that it must be unstructured or seminstructured. A group of managers exist in the Navy, whose responsibility is to assign officers to jobs. Obviously, they are not merely charged with seeing that everyone has just any job, but must attempt to ensure a candidate's skills are consistent with the job requirements. The individuals in this group of managers are commonly called "detailers" within the Navy community. For purposes of this thesis, I have termed the decision area with which they are concerned as "officer utilization." This decision area seems to meet both of the above requirements. Before justifying the statement immediately above, however, the reader should find a more detailed description (or model) of the decision helpful.

Detailers manage human resources (assign officers to jobs) within the general policy framework set forth by the strategic planners. These policies govern such things as rank structure, promotion, subspecialties, obligated service, and tour lengths.

A typical detailer may manage the assignments of well over 1000 officers. Policy generally calls for job

rotation every three to four years, although shorter tours often become necessary. The result is that one detailer may manage a minimum of about 400 job rotations per year, most of which occur during the summer months.

Three considerations influence the detailer's decision of what officer to place in what job: the officer's desires, the career development of the officer, and the needs of the service. The officer makes his desires known to the detailer through periodic submission of an "Officer Preference Card." He may indicate several preferences in order of their desirability by specifying geographical area, job type, or even a specific job.

The needs of the service are known by the detailer through examining the requirements of the position he must fill; what rank is required, what education and experience is necessary or desirable.

Career development is concerned with an officer's development so that his skills may meet the requirements of possible future positions. In general, as an officer progresses, the jobs he fills will require broader experience and expertise. Since no set career pattern exists, the detailer draws from his experience and knowledge in order to judge whether or not a certain job will prepare a particular officer for future positions.

The above discussion clearly implies that detail-

ers are concerned with effective and efficient use of resources. And they do not determine policy but operate within it. Although a single job assignment may be relatively unimportant to the Navy as a whole, groups of individuals matched to jobs are important and can have a widespread impact on the organization. The consequences of the decision can be realized over varying time frames, from very short to quite long. Although the general problem is a recurring one, decisions regarding particular jobs and officers are required only at infrequent intervals. Current information should be available regarding an officer's education and experience in order to properly make an assignment. It appears then in my judgment, that the characteristics of this decision area place it clearly within the management control category as defined in Chapter III.

Also, officer utilization is a semistructured decision area. Additional details of the decision process will help to illustrate this point. Phase 1 of the planning and control cycle, recognizing and defining the problem, is well defined; simply stated, a job requires an officer, or an officer requires a job.

Phases 2,3, and 4, the search for, evaluation of, and selection among alternatives are not so well defined. These three phases represent a cycle within themselves

where the detailer, influenced by the three considerations described earlier, proceeds through a trial and error solution method until he has all officers placed in jobs. Systems support has potential in these three phases.

Reporting on action taken (phase 5) is accomplished on a by exception basis, i.e., if an officer does not report to a new job as ordered, mechanisms exist to make that fact known. However, if an objective is maximum or even reasonable utilization of skill and experience, no reliable feedback on the results achieved in relation to this objective exists (also phase 5). Therefore, h.r.a. system support could be useful in this phase also.

Figure 15 illustrates a general model of the process.

MODEL OF OFFICER UTILIZATION DECISIONS

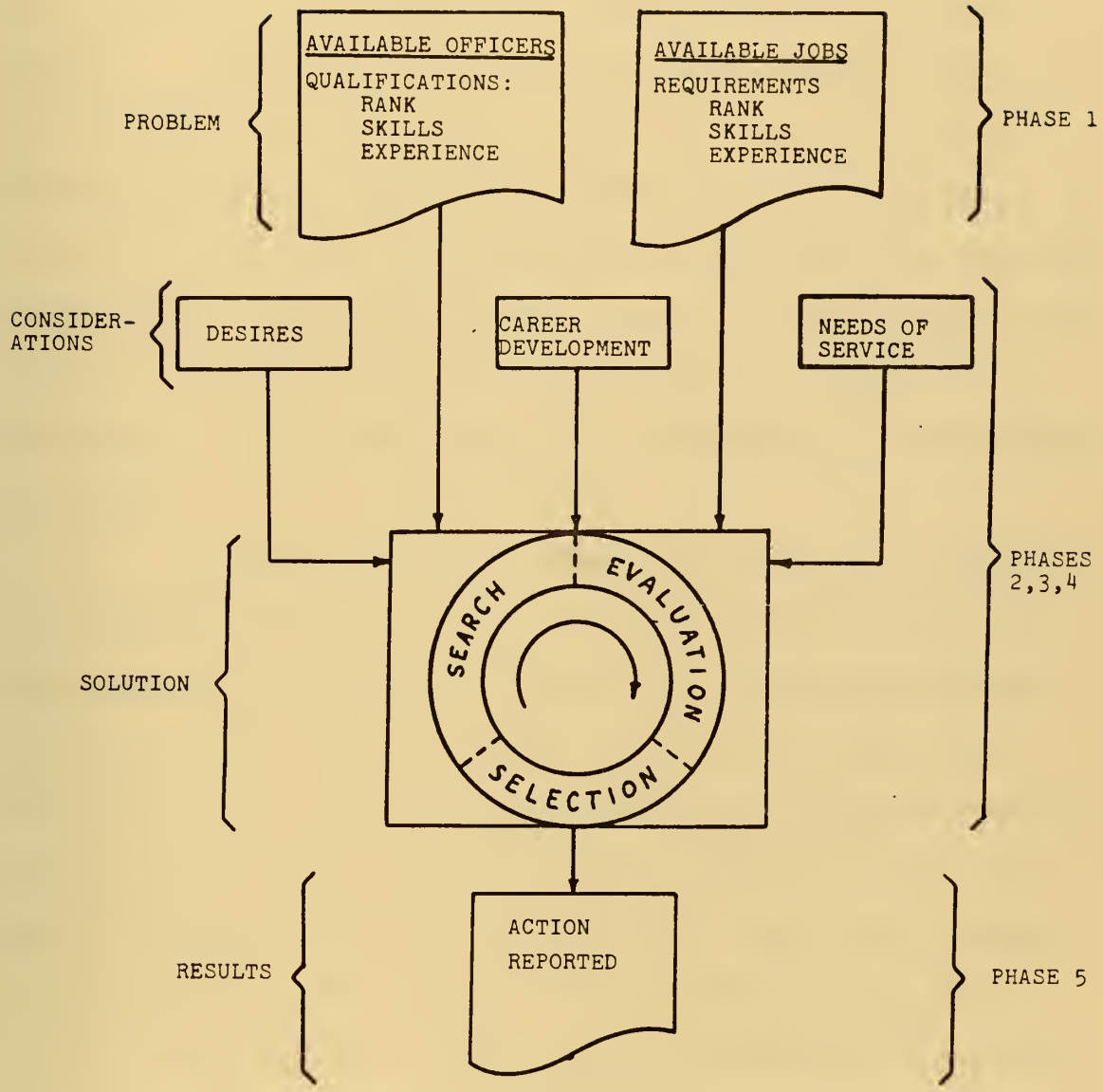

Figure 15

C. H.R.A. SYSTEM SUPPORT FOR AN EXAMPLE DECISION AREA:

Again, the characteristics summarized in Figure 7 are important considerations in designing h.r.a. system support. Detailers place a high value on their ability to interact on a personal basis with the officers they are placing in jobs. Therefore, system support should not interfere with that relationship, and if possible, free the detailer for even more personal contact. The support, then, should be designed for use by the detailer in making his decision, but not for relaying that decision to the officers involved.

Telling an officer what job he is to be placed in is relatively simple. Communicating the justification for that placement is often difficult. Both the detailer and the officer have opinions based on implicit models as to what job is best for both professional and personal reasons. It is unrealistic to assume that the opinions of the respective parties are never in conflict. When such conflict exists, the detailer may particularly wish to adequately justify his decision to the officer concerned. An explicit officer utilization model forms a sounder foundation for such justification than present implicit models. Furthermore, by basing the h.r.a. system on dollars, an easily understood language is provided with which to communicate.

Since detailers are faced with a recurring problem, an analyst can do much more by way of systems support than

displaying individual accounts or providing random access to data. Specific routines can be designed. However, since the decision area is semistructured, and the problem not precisely defined, the decision capability of the system must be limited, and the analyst should be ready to make modifications and improvements to the support provided.

Figure 16 represents a heuristic designed with the above considerations in mind. It seeks a satisfactory solution rather than an optimum one. The basic rule is to place the highest valued officers in jobs first by comparing their qualifications to job requirements and selecting the best match. Career development needs and the officers' desires are considered, and if in conflict, will overrule the decision, forcing the system to consider the next best match. After all officers are placed in jobs, the results are simulated over the time frame individuals are expected to hold the jobs. The resulting total book value can be compared to other solutions and, of course the present total book value.

The results simulation deserves some additional explanation. The purpose of the simulation is to produce a projected book value of alternative matching schemes for a group of officers and jobs. Since our concern now is officer utilization, alternative book values should reflect "good" or "poor" utilization. This can be accomplished by providing for experience investments. The heuristic

H.R.A. SUPPORT FOR OFFICER UTILIZATION

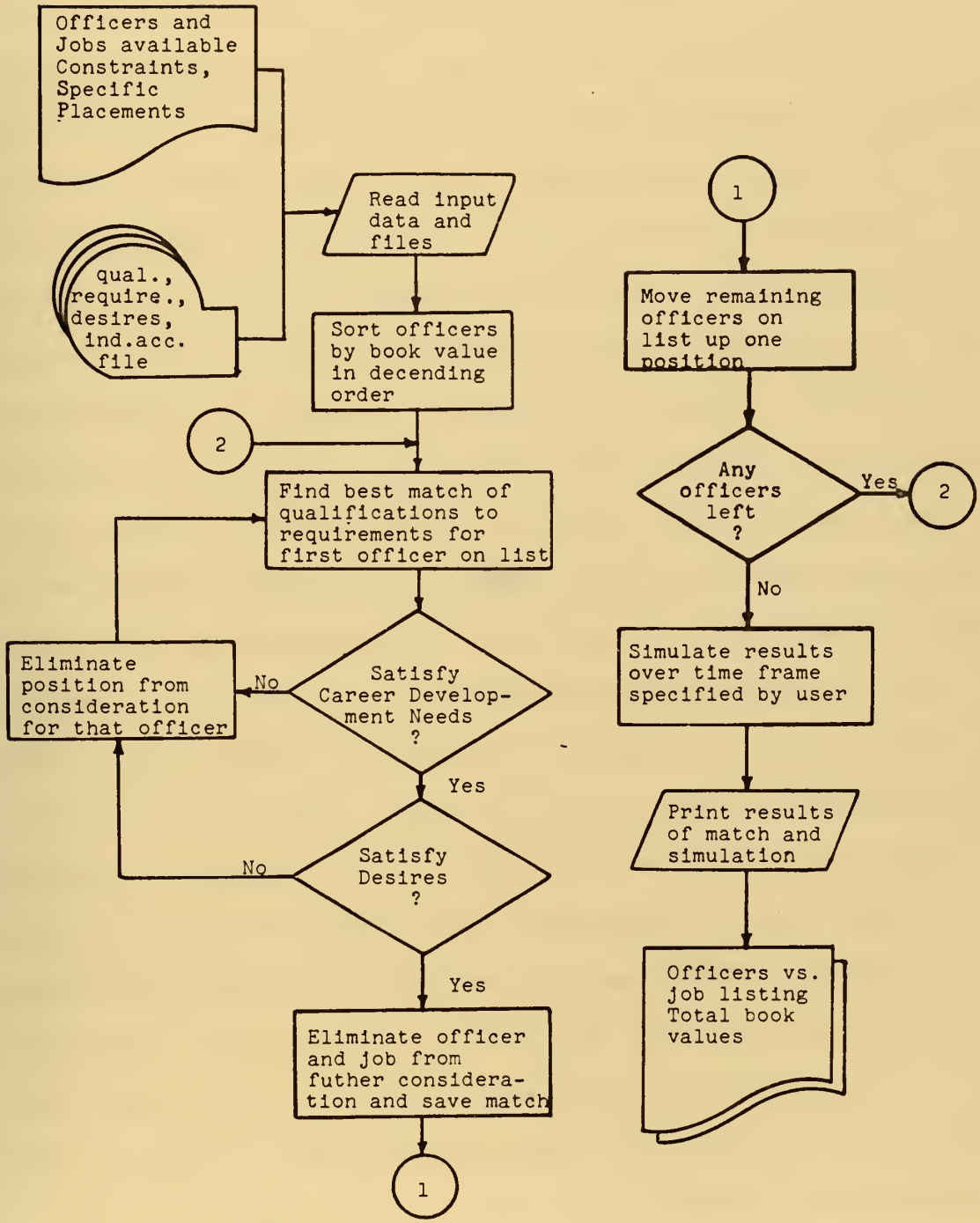

Figure 16

attempts to find the best match of qualifications to requirements within the constraints of officers' desires and career development needs. When a qualification and a requirement are matched, an experience investment is recorded. Although the real value of that experience is difficult, if not impossible, to determine, a value can be determined which would indicate the relative merits of various alternatives. Under the procedures developed in Chapter IV, once an investment in a human resource were made, it would be amortized according to a predetermined schedule. The simulation records an experience investment equal to the amortization for that particular period. This ties the resulting book values to how well qualifications and requirements were matched and the value of particular qualifications. As a simple illustration, consider two officers, A and B, who both attended the same school at a per capita investment of $1000.00, being amortized at $100.00 per year. If A were placed in a job requiring his skills while B were not, an experience investment would be recorded in A's account but not in B's. Furthermore, if the jobs were expected to last three years, the experience investment recorded in A's account would be $300.00 while none would be recorded in B's. If both book values were the same now, a $300.00 differential in favor of A would exist after three years. Now if we consider A and B to be alternatives rather than officers, the higher resulting book value after the simulation period

would indicate the better alternative with respect to utilization. Recall that the claim here is not that experience investments are representative of real values, but that they indicate the relative positions of various alternatives.

The detailer is required to furnish information such as the officers and jobs available, the job requirements, the officers' desires and career development needs, either in the form of input for a particular run or as existing data files. He may also specify special constraints or specific placements in order to allow maximum flexibility.

The specific information provided by the detailer will depend upon what group of officers and jobs he is responsible for. Previous discussion of job requirements, officer qualifications, and officer desires seems clear. However, I would like to illustrate career development information with a more specific example. One group of detailers manages the placement of officers specializing in naval engineering. Although no specific series of jobs have been defined in this area which lead to probable future success, career development needs suitable for inclusion in the h.r.a. approach to officer utilization can be identified. These needs are considered in the more implicit models used presently. At least two of three types of duty are considered necessary during the earlier years of an officer's career. Those three types are categorized as fleet related, industrial, and Washington, D.C. It is also considered

desirable that an officer develop skills in at least two of the following three areas: administrative, technical, and fleet related skills. These considerations can be included in the officer utilization support by simply categorizing jobs by type and expertise developed, and imposing the considerations on the model as decision rules or constraints. Systems analysts, in working with detailers responsible for other types of officers and jobs, can identify similar considerations relevant to that particular area.

The support described here begins to structure phases 2, 3 and 4 of the planning and control process. The detailer, however, is still required to participate in the process and make the final decision.

VI. CONCLUSIONS AND RECOMMENDATIONS

This thesis represents the first of a series of steps leading toward possible implementation of a human resource accounting system within the U.S. Navy. The overall model has been developed, and the input methods and basic processing capabilities have been designed. It was shown that the design of data processing and simulation capabilities which produce output is dependent upon the nature of the decision to be supported. One such decision, officer utilization, was examined, and support designed.

The thesis takes the approach that successful implementation is much more probable when the h.r.a. system is designed in accordance with current management information theory. The difficult problem of convincing personnel managers that human resource accounting is a viable process relevant to many of their information needs was not directly discussed. Navy personnel managers are already extremely interested in personnel costs. In general, this interest can be construed to create a favorable atmosphere for implementation of an h.r.a. system. However, the fact remains that someone still must decide to implement a trial system. It has been my intent in this thesis to encourage a decision for trial implementation, to provide process oriented information necessary to make that decision, and to describe a framework for implementation if the decision were made to

implement an h.r.a. system.

There is so much to be done in the area of accounting for human resources that it becomes almost futile to generate a detailed list of recommendations. The first steps, however, are quite clear. Human resource accounting is of sufficient merit to warrant implementation on a small scale - a system which is not Navy-wide, but considers a smaller group of officers, e.g., a specialized group such as submariners, engineering duty officers, doctors, etc. Or a trial system may be installed at a particular base, activity, or command. Once implemented, the impact of the system must be carefully monitored, not only the impact of systems support on decision making but also the reactions of people to their being considered human resources.

Only after success is demonstrated on a small scale should implementation of large systems be undertaken. Accounting for people as assets is a relatively new concept and takes "a little getting used to." But human resource accounting, properly implemented, can lead to significant advances in managing the Navy's human assets.

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SAMPLE PER CAPITA PROCUREMENT INVESTMENT FILE

Program j	Investment IP(j)
Naval Academy	$ 35
NROTC	$ 50
Officer Candidate School*	$1,397

*This includes a variety of programs, but at present only the average over all programs is known.

SAMPLE PER CAPITA TRAINING INVESTMENT FILE

Course k at Cost Center j	Number of Weeks in Course k NW(k)	Per Capita Training Investment IT(j,k)
Advanced Undersea Weapons Circuits	12.0	$2,034
Communications Officers Ashore	4.0	273
Communications Officer-Fleet	15.0	1,024
Damage Control Assistant	10.0	786
Deep Sea Diving Officer	21.0	5,931
Electronics Officers Maintenance	34.0	4,132
General Shipboard Firefighting	1.0	79
Military Justice - Non-Lawyer	5.0	371
Mine Countermeasures Officer	7.0	950
Navy NucWeps Officer	8.0	2,008
NBC Defense (Afloat)	5.0	393
NBC Defense (Ashore)	6.0	1,691
Radiographic Safety Officer	2.0	339
Ship Salvage Diving Officer	14.0	3,954
SSBN Navigation Officer	10.0	1,417

SAMPLE PAY AND ALLOWANCES FILES (OFFICERS)

Basic Pay: B(i,j)

Pay Grade: i \ time in service: j	<2	<3	<4	<6	<8	<10	<12	<14	<16	<18
1	531	553	668	668	668	668	668	668	668	.
2	611	668	802	829	846	846	846	846	846	.
3	701	784	838	927	971	1007	1061	1113	1141	.
4	755	918	980	980	998	1043	1113	1176	1230	.
5	-	-	-	-	-	1124	1158	1220	1301	.
6	-	-	-	-	-	-	-	-	1355	.
7	.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.	..

Quarters Allowance Q(i,k)

Pay Grade: i \ Dependents: k	Single	Married
1	108.90	141.60
2	138.60	175.80
3	158.40	195.60
4	178.80	215.40
5	198.30	238.80
6	211.80	258.30
.	.	.

Appendix A

WORK SHEET FOR PER CAPITA COST OF TRAINING
FISCAL YEAR _____

(BUPERS Report 1500-7)

Item 1. Name of School or Activity _____

Item 2. Location _____

		Cost Items	Cost Sub-Totals
Item 3a.	Cost of Direct Training (BUPERS)	_____	
Item 3b.	Cost of Direct Training (Other)	_____	_____
Item 4a.	Cost of Training Mission Support other than real property (BUPERS)	_____	
Item 4b.	Cost of Training Mission Support other than property (OTHER)	_____	_____
Item 5.	Cost of Maintaining real property facilities	_____	_____
Item 6a.	Pay, Allowance & Subsistence of Military Logistic Support Overhead	_____	
Item 6b.	Pay, Allowance & Subsistence of Military Logistic Support Overhead	_____	_____
Item 7a.	Travel, Staff	_____	_____
Item 7b.	Travel, Students	_____	_____
Item 8.	Other costs, if any	_____	_____
Item 9.	Total of Items 3-8	_____	_____
Item 10.	Pay, Allowance & Subsistence of Students.	_____	_____

STUDENT DATA

Item 11a.	No. Navy students graduated in FY 1971	_____
Item 11b.	No. STUDENT-WEEKS of instruction of Navy students graduated in FY 1971	_____
Item 11c.	Attrition rate for Navy students	_____
Item 12a.	No. "Other" students graduated in FY 1971	_____
Item 12b.	No. STUDENT-WEEKS of instruction of "Other" students graduated in FY 1971	_____
Item 12c.	Attrition rate for "Other" students	_____
Item 13a.	Total Student Input - FY 1971	_____
Item 13b.	Total Student Output - FY 1971	_____
Item 14a.	Cost per student	$_____
Item 14b.	Cost per STUDENT-WEEK	$_____

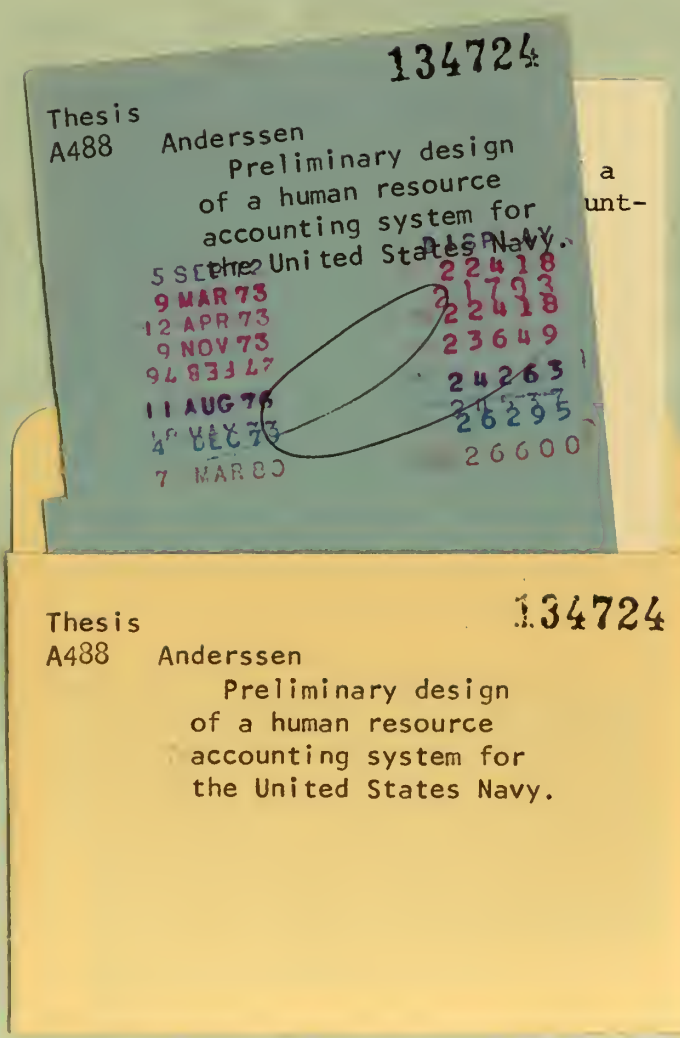
OTHER DATA

Item 15a.	Capacity - Daily Load	_____
Item 15b.	Physical Capacity - Daily Load	_____
Item 16a.	Length of Courses _____ week(s) through _____ week(s)	
Item 16b.	Average Length of Course _____ week(s)	

NON-INSTRUCTIONAL COSTS

Item 17b. Total Costs to Navy for functions other than instruction of resident students $_____

Item 17b. Identify the functions:



Thesis
A488 Anderssen
Preliminary design
of a human resource
accounting system for
the United States Navy.